EPCL Programmer's Guide

Zebra

Card Printer Solutions

Basic Models:

RFID Models:

RFID Plus Log-On Security Models:

JOLLY ROGER CASINO
Captain's Club
OLIVIER WILLEMS
64983319

Cactus County JUDICIAL SYSTEM
Officer BARRY ROGERS
Badge No. B1305456

FEDERAL INTERNATIONAL AIRPORT
DENNIS JAMES
611-82-46812
MECHANIC
LEVEL 3 ACCESS
TERMINAL 8

980415-001D

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INTRODUCTION

This manual describes programming commands that control operations and deliver data for the following card printer models:

Models	Features				
	RFID	**Color Printing**	**Duplex Printing**	**Duplex Lamination**	**Log-On Security**
P110i	•	•			
P120i	•	•	•		
P205					
P210	•	•			
P310F					
P310C		•			
P310i	•	•			
P320i	•	•			•
P330i	•	•			
P420		•	•		
P420i	•	•	•		•
P430i	•	•	•		
P520		•	•	•*	
P520i	•	•	•	•*	•
P720	•	•	•	•†	

* Model that laminates duplex using same lamination patch type for both card sides
† Model capable of applying different upper and lower lamination patch types onto cards

All models employ a Common Command Set plus additional Command Sets for any model-specific features. All models ship with Windows drivers. Associated programming for use in the Windows environment is not necessary.

Common Features

All covered models can print bar-codes in several formats and have resident scalable font descriptions. Also, all models can include a Smart-Card Docking Station. P310 and P420 variants can have a Proximity Card docking Station. All models are offered with or without a Magnetic Stripe Encoder. A Serial Host Interface is optional on the P205, P210, P310, and P420 variants, where an associated RS-232C Setup Command exists. All models can have USB Ports, either standard or as an option.

The programming commands control the printing process by color and by ribbon material, allowing overprinting and separate control of various protective coverings.

Programming Objectives

The Escape Commands allow printer setups, many of which determine how a Printer Module Element reacts upon receiving an incoming card. For example, a data download must occur before the Printer Module can print a card or encode a magnetic stripe.

Except for the Card Feeder, each module has an Input Sensor that triggers the responses determined previously by setup commands.

Card Sensors also allow the Firmware to keep track of the position of the card in the Card Path. Therefore, the need for card positioning occurs as an automatic response to related commands. For example, with no card in the Card Path, a Print Command produces a Card Feed. Similarly, if a Print Command occurs after a card has passed beyond the Print Head, the card first returns to the Print Head.

Ribbons come in different panel configurations, and how the printer responds to a Print Command varies according to the Ribbon Type Command Parameters specified. For each ribbon type, a related print sequence exists. However, all models equipped with the RFID feature sense the ribbon type, and firmware takes care of this parameter.

While some commands affect just one printer module, others can produce responses from more than one. Also, some commands serve as setups for a particular printer and, therefore, need not be reestablished for each print job. Notably, all command parameters end up in Flash memory.

Ribbons   Ribbon types exist in the following configurations:

- **Continuously Coated Monochrome Ribbons** are Thermal Transfer Ribbons having a resin coating and no panel separations. Zebra offers these in several ribbon colors along with a Scratch-Off Gray, usable in all models but an obvious choice for use in Monochrome Printers.

- **Black Sublimination Dye alternated with Varnish Panels** that image black and white gray-scale elements. An excellent choice for imaging black-and-white photo images, followed by an application of a UV protective coating.

- **Black Resin alternated with Varnish Panels** that image fully saturated black and apply a protective coating. Ideal for imaging solid graphic elements such as Text and Bar Codes.

- **Yellow, Magenta, and Cyan Panels** for imaging only Dye Sublimination Color. Typically used in printers with no requirement for Resin or Varnish. Notably, Yellow, Magenta, and Cyan Panels can combine to produce Black, and a Laminator removes a need for Varnish.

- **Yellow, Magenta, and Cyan Panels for imaging Dye Sublimination Color followed by Black Resin and Varnish Panels**. Dye Sublimination Images should have a protective coating, and Black Resin serves as an excellent choice for Text and Bar Codes. Thus, Color Printers without Laminators typically use these ribbons.

- **Yellow, Magenta, and Cyan Panels for imaging Dye Sublimination Color followed by a single Black Resin Panel**. While a Laminator precludes the need for varnish, a solid resin black produces the best Bar Codes and offers another, sometimes better, way to image Black Text and other black graphic elements.

- **Yellow, Magenta, and Cyan Panels for imaging Dye Sublimination Color followed by a two Black Resin Panels**. This ribbon offers imaging for color plus resin on one card side and only resin on the other side while using single set of ribbon panels.

Printer Ribbons	*Panel Count	Models				
		P205 P210	P310 P320	P420	P520	P720
K_{resin} (all monochrome colors)	1	•	•	•	•	•
Scratch-off Gray	1		•	•	•	•
$K_{resin}O$	2		•	•	•	
$K_{dye}O$	2		•	•	•	
YMC	3				•	•
YMCK	4				•	•
$YMCK_{resin}O$	5	•	•	•		
$YMCK_{resin}K_{resin}$	5				•	•
$YMCK_{resin}OK_{resin}$	6			•		
* P310 monochrome and P205 printers only use 1-panel ribbons.						

Modular Elements:

- **Print Engine**—Being the primary controlling element in all printer models, the Print Engine CPU receives Host Commands. Received commands can encompass operations that directly control the Print Engine and operations that draw on other Printer Elements for execution. Whereas some elements have their own CPUs, the Print Engine CPU exercises complete control over other elements. Only in P520s and P720s can a command be directed to another element (the Laminator CPU). An associated Element-Specific Command Prefix exists for this purpose. Besides its print function, Print Engines have Options that include a Magnetic Stripe Encoder and/or a Smart Card Docking Station. Some Models also offer Proximity (Contactless) Card Docking as an alternative to Smart Card Docking.

- **Card Feeder**—This element delivers cards placed in the Card Input Hopper to the Card Path inside the Printer under control of the Print Engine CPU.

- **Card Flip**—Printers with this element can flip cards in preparation for duplex printing or, in the case of a P520, Second Side Lamination. Card Flip Stations can also deliver cards with sensed flaws to the Rejected Card Box. This element has its own CPU that carries out the details of instructions received.

- **Single Side Laminator**—P520 Printers can place a protective transparent patch on one card surface at a time. This element also has its own CPU that carries out the details of instructions received.

- **Duplex Laminator**—Printers with this element laminate both card surfaces in a single lamination pass. This element also has its own CPU that carries out the details of instructions received.

- **Operator LCD Control Panel**—Printers with this element convey messages to operators via a 1- or 2-line by

16- character LCD screen and allow operator responses and Printer Control. Power and Alert LEDs also appear. This element also has its own CPU that carries out the details of instructions received.

Significant model/configuration differences related to programming include the following:

- **P310 Monochrome** card printers have a smaller command set along with an image buffer sufficient for a one-bit image mapping depth. Imaging using Thermal Transfer Methodology occurs, supported by Thermal Transfer Printer Ribbons. (Only fully-saturated dots image in a single print pass.) Any gray-scale imaging requires host data mapped into multiple-dot matrixes, sized for the desired gray-scale range (e.g., a four-by-four dot pixel matrix can produce 16 levels of gray plus white, $[(4 \times 4)^2/16 + \text{white}]$). Gray Levels derive from the number of dots imaged inside the matrix.

- **P310 Color** card printers employ dye sublimation methodology for color imaging and thermal transfer methodology for imaging from Resin Monochrome Ribbons or Ribbon Panels. A yellow, magenta, and cyan imaging sequence occurs. Each ribbon panel produces images from five-bit-per-dot data.

  The black panels on Zebra-supplied ribbons with color panels have a resin coating that particularly suits bar-code and other solid image printing (i.e., no gray scale). However, resin responds poorly as a dye sublimation print medium. Therefore, the black used for gray-scale imaging comes from formulations of yellow, magenta, and cyan (YMC), which means dye-sublimation black also has a five-bit-per-dot range (32 levels of gray). If the need for a resin-panel-generated gray scale should ever become necessary, associated host data must be mapped into multiple-dot pixel matrixes as noted in the P310 Monochrome description.

- **P310 Color Card Printers** have five image buffers—three for color and another for two for monochrome. The color buffer receives downloads of Cyan, Magenta, and Yellow image data, each five bits deep. The Monochrome Buffer receives black and/or varnish data one bit deep. Separate data for Resin Black and Overlay Varnish can often be avoided. Because of its durability, card areas with resin images may not require varnish for the associated ultraviolet protection. Therefore, by using a reverse imaging for varnish, the same bit-map used for resin produces a varnish overlay that omits the areas with resin. Also, through reverse imaging, a Clear Command can prepare Monochrome Memory for a full-coverage varnish.

- **P420s** employ the same Print Engines as the P310 Color described above. Because P420s also have a Card-Flip assembly and a Rejected Card Box, these models have some additional related commands. P420s also have an interface that supports the programming of Proximity Cards (also called Contactless Cards). Memory size is doubled to support two-sided printing.

- **P520s** have all the same implementations as a P420, including Smart Card stations, and Magnetic Encoders as options. However, P520s also have a Card Laminator Station. Laminators serve as heat-transfer devices for material or panels contained on Lamination Ribbons. A variety of these kinds of ribbons exist, as follows:
    - Ribbons with transparent die-cut patches that offer near edge-to-edge card coverage
    - Die cuts with cutouts for Smart Card Contacts, and smaller die cuts that serve to avoid Magnetic Stripes
    - Preprinted Patches that contain security devices such as graphics, holograms, or other optically-encoded safeguards

    P520 Laminators can also serve a heat-transfer function for ribbons containing a coating instead of die-cut panels. However, only a total card application can occur. Because the Print Station can have a Dye Sublimation Ribbon with Varnish Panels, many choices exist for selection of protective coatings. Additional commands exist to implement Laminator use.

    - Instead of just an <Esc>, a P520 Command meant for the Laminator needs a preceding:

    <Esc>#<Space>1<Space>

• **P720s** have P420 elements plus a Laminator module that fully implements simultaneous near edge-to-edge patch applications from above and below the Card Path. Integral sensors assure accurate patch placements and signal the Ribbon Types in use and the amount remaining on their cores.

Basic Command Syntax

Each command begins with a Command Initiator (the Escape Character). For P520s, directing characters can follow the Escape Character.

The Command Initiator serves to mark the character(s) immediately following as command characters. Command characters vary between one and seven characters (or up to seven bytes of hexadecimal data).

Some Commands then have one or more Parameters to supply the printer with information necessary to complete the command. A Space Character delineates individual Command Control Parameters. The following Text Command shows a typical example.

Each Command Line requires a Carriage Return Character (13 dec. or 0D hex.). The Printer ignores a single Line Feed (LF) character (Dec. 10 or 0A Hex.) when it immediately follows the command terminating Carriage Return. Most PC Based Systems send a CR/LF when the Enter Key is pressed.

Command Name

WRITE TEXT

<Esc>T p1 p2 p3 p4 p5 p6 p7 *data*<Rtn>

Command | Parameters | Text

<Esc>T 100 100 0 1 20 30 1 Text<Rtn>

ASCII Programming Code

1B542031303020313030203020312032302033302031205465787470D

Hexadecimal Programming Code

Space (Delimiters)

Escape (Command Initiator)

Carriage Return (Command Terminator)
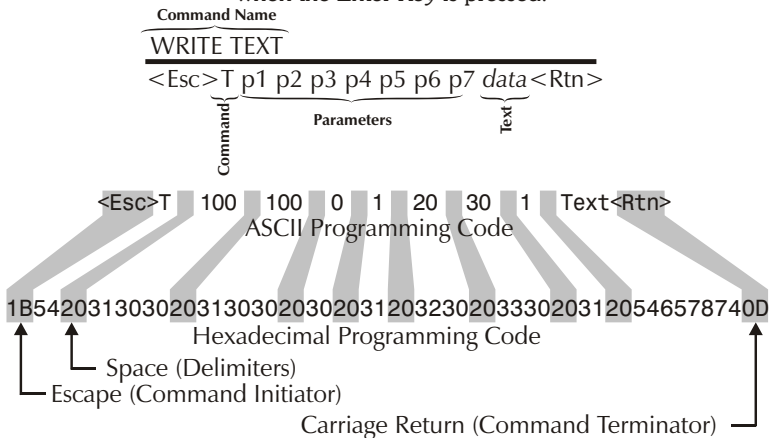
Command Editor   Any ASCII based Text Editor can serve to create simple command files. In the DOS environment, MS-DOS EDIT offers a good choice. To execute the file, use the Print Command from the editor, or from DOS, the COPY Command, to send the file to the printer. Examples using the COPY Command are:

```
COPY file name.ext LPT1
```

For more information on the use of the COPY command, refer to a DOS Software Manual.

Some text editing programs can cause printer errors by adding extra characters or by changing existing characters when generating a near ASCII formatted file.

Example: A common ASCII editor, BRIEF, changes all NUL characters to the SPACE or TAB characters with a File Save. The graphic data for print intensity level "0" is the NUL character. This causes the resulting file to print with horizontal lines in all graphics with solid white (i.e., no-print) areas. Other editors may add a SUB character (Dec. 26 or 1A Hex.), which causes the printer to error.

Image Memory Arrangements   Figure 1-1 shows elements involved in image data flow. Note that two Image Memory Configurations exist and that Image Memory always contains compressed data. Ideally, hosts should send compressed data, which requires a compatible compression algorithm. This can substantially reduce the data transfer times of most image files.

Monochrome Printers need no Color Buffers and offer less memory capacity. Color Printers may need as many as five buffers and, therefore, have a greater memory capacity. In most cases, compressed data for an entire card image fits into available memory in a single download sequence.

Color-separated data enters related buffers due to a buffer-specifying parameter in the Color Data Command.

**Figure 1-1
Image Memory
Arrangements**
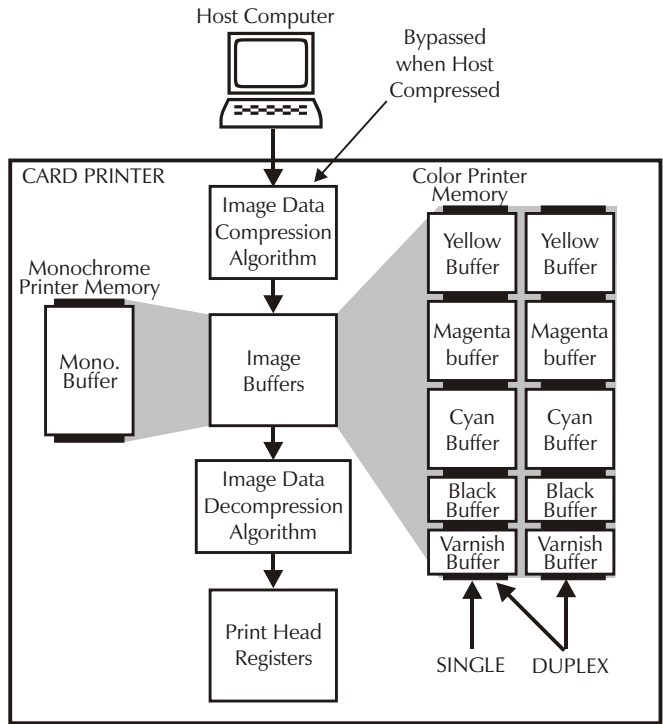
Bit-Map Compression Algorithm

Characteristically, a Bit-Map Compression Algorithm flags data segments as either repeating or non-repeating, specifies the bytes repeated, and the number of repeats. For these card printers, compression applies to byte-wide bit-map segments, which the host sends with the PS, GS, Z, and vZ commands. The PS and GS commands include parameters specifying a buffer (YMCK). Monochrome commands Z and vZ send associated bit-map data to the Black (K) and Varnish Buffers, respectively. All of these commands include parameters that specify whether or not the command applies to compressed data. For recognition by the card printer, compressed data must conform to the following rules:

Rule 1. When high, the most significant bit (the Flag Bit) of a two-byte sequence indicates that the second byte repeats. The remaining seven bits of the first byte specify the number of repeats, allowing a field-specification range of from zero to 127 repeats.

Rule 2. When low, the Flag Bit of a data sequence indicates that the remaining seven bits of the byte specify the number of following bytes that represent non-repeating image data. Here, however, the range allows a specification of from zero to 31 bytes of data.

Rule 3. The first byte in the Data Field of any command specifying a Compressed Bit-Map must have the Compression Flag high, even if a one must be entered as the number of bytes repeated.

Rule 4. No other algorithm can be used to compress image data for this card printer.

Figure 1-2 includes examples of data strings employing compression.

Figure 1-2
Bit-Map
Compression

```
                                    0XXX XXXX  ---Bytes (0~31)---
        Data Compression Flag Off ──┘
      No. of Non-Compressed Bytes ─────────┘
            Non-Compressed Data ────────────────────┘


      Mono. Panel 8-Dot Data Field ────────────────┐
                                    1XXX XXXX XXXX XXXX
            Data Compression Flag Set ──┘
              No. of Repeats (1~127) ─────────┘
                  Data Byte Repeated ────────────────────┘


      Dye Sub. Panel 1-Dot Data Field ──────────────┐
                                    1XXX XXXX XXXX XXXX
          Data Compression Flag Set ──┘
            No. of Repeats (1~127) ──────────┘
                Data Byte Repeated ─────────────────────┘
```

Compression Example 1

0001 1111 0001 1111 0001 1111 0001 1111 0001 1111 0000 0011 0000 0011 0000 0011

| 1F Hex (5 repeats) | 03 Hex (3 repeats) |

| 85 1F | 83 03 |

Compressed Data
1000 0101 0001 1111 1000 0011 0000 0011

Compression Example 2

0001 1111 0001 1111 0001 1111 0001 1111 0001 1111 0000 0100 0000 1011 0000 0011

| 1F Hex (5 repeats) | 04 0B 03 Hex (0 repeats) |

| 85 1F | 03 04 0B 03 |

Compressed Data
1000 0101 0001 1111 0000 0011 0000 0100 0000 1011 0000 0011

Figure 1-3 shows how a bit-map relates to associated non-compressed data. Figure 1-4 shows the same bit-map in association with compressed data.

Figure 1-3
Non-Compressed
Bit-Map

1 Byte

x axis
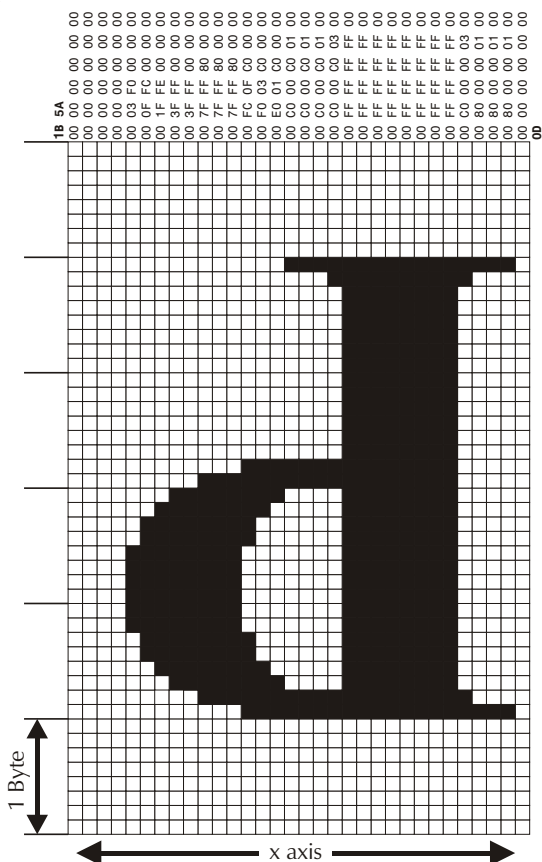
Figure 1-4
Compressed
Bit-Map

1 Byte
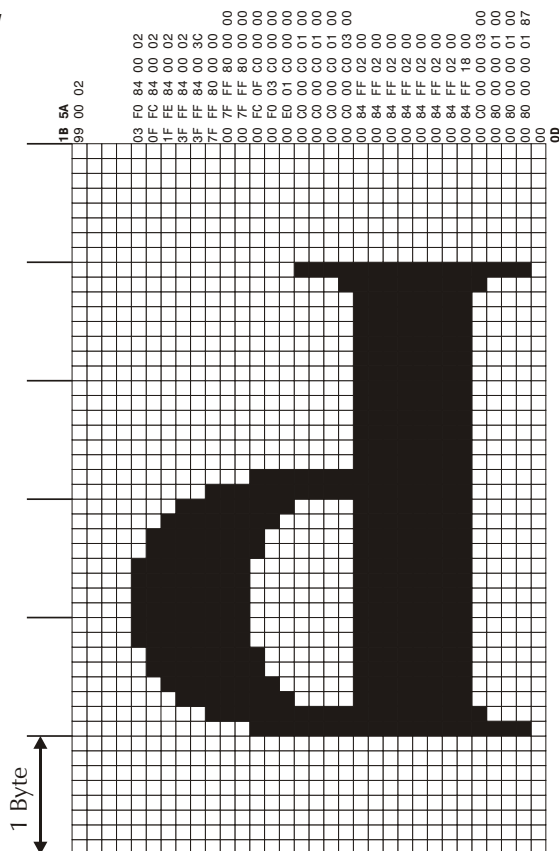
Data-to-Card Mapping

Figure 1-5 shows a card consistent with the orientation of a card traveling right to left in the Card Path of a printer. From this perspective, the data field of the PS, GS, Z, and vZ commands first becomes a memory-resident image in a designated image buffer. The Image Buffer, as shown, fills from top to bottom and from right to left. Because the Image Buffer has a last-in-first-out (LIFO) arrangement, card images build from bottom to top and from left to right. This suits the front-to-back loading of Print Head Registers and the right-to-left card movement during print cycles. As noted in the figure, an object mirrored in both axis in the data sent to the buffer would print normally on the card.

Figure 1-5
Data Sent verses
Card Mapping

Download Buffer Data Command
Buffer Select (YMCK) Parameter
Compressed vs. Uncompressed Parameter
Data Downloaded (300dpi/11,8dpmm)

PS p1 p2 *data...........................data*

Last In
First Out

Image Buffer

Print Buffer Command
Buffer Select (CMYK) Parameter

IS p1

Print Direction

Card Size
3.375 x 2.125 in
85,7 x 53,9 mm

Partial-
Image
Origin

MAXIMUM CARD IMAGING
646 Line Bytes by 1030 Lines
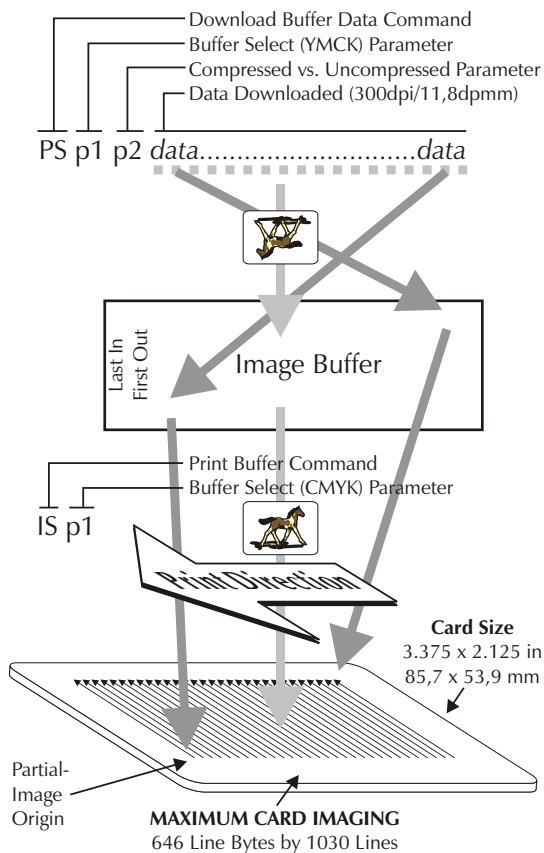
ASSOCIATED COMMANDS

Monochrome	Overlay	Color
G	IH	PS
O	IV	GS
Z	vZ	IS
P	vP	
L*	vL*	
C*	vC*	
D*	vD*	
T	vT	
B	vB	
I		

* Objects drawn with these commands have an upper-left origin.

*Laminator Data
Considerations*

Associated printers have no need to print varnish.
However, the Varnish Buffer stores monochrome data.
Therefore, all data commands for monochrome data
require the "v" preface. A subsequent "I" command
prints data stored in the Varnish Buffer. Note that the IV
Command serves to indicate the presence of a ribbon
with varnish panels that then get bypassed.

Color Printer Data Considerations

When converting from another color system to CMY, the best possible results occur when a table maps each source color to a visually equivalent CMY printer color. Such a table must convert all possible printer colors. Also, the conversions must be fine-tuned to produce optimum results. However, for RGB data, a simple conversion can occur via the following:

Y = 255 - B

M = 255 - G

C = 255 - R.

Color data always enters a color image buffer, either as Yellow, Magenta, or Cyan. This is also true for $K_{dye}O$ ribbon, which images with black dye. The command designates the buffer differently according to the Buffer Specification Parameter in the command. Note that the specification for Dye Sublimation only applies to images produced using a Dye Sublimation Black Ribbon. All data associated with these commands represent imaging consisting of five-bits-per-dot.

Whether downloading data for a partial image (GS command) or for a complete card image (PS command) the data must match the associated card area. For partial images (sometimes called logos because of a typical application) the GS Command Parameters specify the area imaged. This assures proper line breaks. Any either over- or under-flow produces an error. For proper appearance, color images should not overprint other card printing.

Monochrome Data Considerations

P-Series Printers always download monochrome data into a Monochrome Image Buffer. In printers without Laminators, monochrome data commands prefaced with a "v" designate the Varnish Buffer. Commands without the "v" preface designate the buffer used for resin printing. If only one Monochrome Image Buffer exists, the command designates the buffer differently depending on the associated data.

However, most color imaging does not need a pre-established Varnish Buffer to apply the varnish coating. If no Varnish Buffer is downloaded, the printer defaults to the Resin Buffer for the application of varnish. This works for three reasons. First, color ribbons have resin black followed by varnish panels, both limited to monochrome data. Second, the primary use of varnish is to protect the dye sublimation imaging from ultraviolet radiation. Third, because resin may need no varnish protection, an inverted-resin bit-map can apply varnish. The IV command has a parameter setting to produce an inverted data print. Therefore, when suitable, leave the Resin Buffer unchanged after printing resin. Then, issue an IV command to print the varnish.

Note that full-coverage varnish, as required for ultraviolet protection using dye-sublimation black ribbons, requires only a buffer clear command (F) followed by the inverted print command (IV).

A watermark simulation can result by, in effect, punching holes in the varnish image. Similarly, suitable holes in the varnish application are necessary to prevent coverage over Magnetic Stripes or Smart Card Contacts. However, this concern can be avoided by limiting images requiring varnish to the card sides without contacts or stripes.

A hologram transfer from an associated ribbon occurs by printing a Varnish Buffer that images the area of the ribbon containing the hologram. Both of these images require data previously downloaded into the Varnish Buffer.

Monochrome graphic objects can download into either a Resin or Varnish Buffer. As with the preceding, a "v" preface designates a buffer that prints with the "IV" Command, and commands without the "v" preface designate a buffer that prints with the "I" Command. Commands exist for downloads of the following graphic objects:

P/vP	Write Dot
L/vL	Write Line
C/vC	Write Box
D/vD	Write Diagonal Line
T/vT	Write Text
B/vB	Write Bar-Code

The following Graphic Commands have Rotational Parameters (clockwise):

D/vD (Diagonal Line)	0, 90, or 180°
Center of Rotation	lower-left
T/vT (Text)	90° Increments (0~270)
Center of Rotation	lower-left or object center
B/vB (Bar Code)	90° Increments (0~270)
Center of Rotation	lower-left or object center

Monochrome bit-maps require entry of two commands—first an initializing command (G) and then an associated data command. The "G" Command specifies image placements associated with the following commands:

O/vO	Download Single Line
Z/vZ	Download Multiple Lines

Figure 1-5 shows the relationship between data sent by "O" or "Z" commands and an area previously established by a "G" command. The "G" command can also define data as single bits (i.e., image dots).

With dots selected as the Data Mode in the G Command, data sent to the printer must, nevertheless, finish on an even byte boundary. When necessary, fill in zero bits to bytes that do not reach the boundary specified in the G Command.

Data is handled in bytes decimal (0~255) or hexadecimal (00~FF) by the printer.

Bar Codes

Bar Codes vary in capacity, size, character sets, and density. Several industries have adopted specific coding and bar code formats. A selected Bar Code must match a code supported by the scanning equipment.

All the Bar Codes offered by the card printers have the data characters, 2 quiet zones, and Start and Stop Characters. The Bar Codes can include Text as part of the Printed Bar Code. Some of the Bar Codes include a printer-generated Check Digit (or Data Check Sum) Character automatically or as an option.

A command error condition occurs when Image Data extends beyond the addressable range of the Image Buffer. The Bar Code and Text Fields must remain within the addressable area of the Image Buffer. Each of the Bar Codes, in the Command B and Appendix-A Descriptions have a formula to determine a Bar Code Length.

Selecting a larger Bar Code Width Multiplier and a higher ratio of the narrow to wide bars (and spaces, where applicable) improves the general readability of a Bar Code. Also, wider bars and spaces increase the depth of field for improved performance with Moving-Beam Lasers and other non-contact scanning devices.

Control Commands

The card printers can perform a variety of print, card, ribbon, head movement, and other control command operations.

Print Controls

Intensity—Adjusts the amount of heat used to transfer Maximum Intensity Color or Monochrome Dots.

Contrast (Color Only)—Adjusts the minimum amount of heat used to print dots at the lowest color setting.

Image Positioning—Locates the printable image on the card.

Head—Raises the Print Head for card moves and lowers the head to print. These commands are nested within Print Commands and typically only support testing.

Print Test Cards—Initiates a print sequence using printer-resident data.

Card Movement

Print Ready Position—The card moves to a position just prior to the Card Edge Sensor.

Exit Card—The printer sends the card to the Output Hopper. For printers with multiple stations, cards exit to the next station.

Duplex—Flips cards using the Card-Flip Station, initiated by the MF command.

Ready Smart Card—Positions a Smart Card under the Smart Card Docking Station, where Smart Card Chip Contacts make contact and become available at a rear-mounted printer connector.

Encode Ready position—The card moves to a position just prior to the Read Write Head of the Magnetic Encoding Station.

Reject Card—Sends a card to the Rejected Card Box

Ribbon

Reset Ribbon—Advances ribbon to prepare for the first imaging pass (for color, Yellow) or cycles a continuous color Monochrome Ribbon.

Select Panel—Resets, then advances ribbon to a command-specified panel.

Card Handling Process The following outlines a recommended card handling sequence:

1. Smart Card Programming - Option
2. Magnetically Encode Card - Option
3. Print Card
   For color, print:

Yellow

Magenta

Cyan

Black

Clear Varnish

4. Duplex - Flip Card - Option
5. Print Card Backside - Option
   For color, print:

Yellow

Magenta

Cyan

Black

Clear Varnish

Hologram Lamination
6. Eject Card

Never image or laminate over magnetic stripes or Smart Card Contacts. Encoding and/or Smart Card Programming Errors can result. Those with lamination capabilities can order patches that leave these areas uncovered.

Command Linking The "M" and "m" Commands serve as Command Linking Operators. A string of linked commands may execute one or multiple times. The "[" character serves as the delimiter for Linked Commands in the associated syntax.

For the complete "M" Command Syntax, and an example, see M/m in the Command Reference.

Sample Card

Figure 5-6 shows a printed card along with the commands used.

Figure 1-6
Sample Monochrome
Card

Commands	Descriptions
+RIB	Ribbon Type, Monochrome
+C 4	Thermal Intensity
F	Clear Mono. Buffer
B 512 600 4 0 2 4 100 1 TEST	Write Bar Code
T 512 75 4 0 0 35 1 Company Name, Incorporated	Write Text
T 200 200 0 1 0 50 1 FIRST NAME	Write Text
T 200 300 0 1 0 50 1 LAST NAME	Write Text
T 200 400 0 1 0 50 1 ACCOUNT NUMBER	Write Text
T 65 320 7 1 0 50 0 Reverse text	Write Text
L 15 80 970 4 1	Write Line
I	Print Monochrome
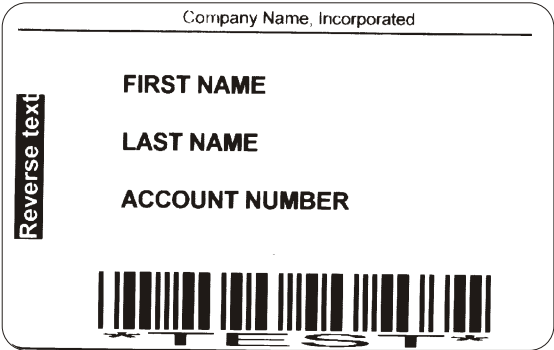
Parallel Port Signals	P205, P210, P310 and P420 Printers have a Serial Port Option. Serial equipped printers communicate with the host over an RS-232C interface using ACK/NAK flow control. Parallel Ports are standard. The other card printer models have no Serial Port Option.

Card printers *with* Parallel Ports communicate with the host using the following signal lines:

DATA (0~7) Eight bits of parallel data.

STROBE (Pin 1) A host signal that indicates stable data.

ACK/ (Pin 10) A printer signal that indicates data received. The host drops the STROBE signal in response.

BUSY (Pin 11) A printer signal that indicates an inability to accept commands due to ongoing processing. In printers with more than one processor, a BUSY response from one processor does not imply a BUSY at the another processor.

READY (Pin 13) A printer signal that indicates its availability to receive Host Commands.

PAPER ERROR (Pin 12)
Card printers report errors to the host by encoding the PAPER ERROR and ERROR lines (see Error Line Coding below).

ERROR/ (Pin 15) Card printers report errors to the host by encoding the PAPER ERROR and ERROR lines (see Error Line Coding below).

INIT (Pin 14) Not used.
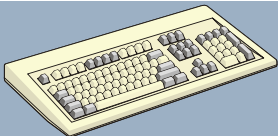
Error Line Coding

Paper Error	Error	Description
0	1	No Error
0	0	Syntax Error
1	1	Ribbon End/Empty Feeder
1	0	Mechanical Error

COMMAND REFERENCE

This section contains individual command descriptions for data downloads, printing, lamination, magnetic encodes, and card movement control. An included command list groups commands by function and shows the associated applicable printer models.

*Figure 2-1
Command Entry

Esc	Command Initiator—Press <Esc> to indicate Command String follows.
Space	Command String Delimiter—Use Spaces <Sp> between Commands and Parameters.
Enter	Send Key—Press <Rtn> to send Command String to Printer.
#	Placed after and followed by number (n) (<Esc>#<sp>n<Sp>) directs Command to Station n.
P₁~Pₙ	Indicates Required Parameter(s) in String
{P₁~Pₙ}	Indicates Optional Parameter(s) in String
data	Indicates Data Position in String

2-1

Command List

COMMAND	DESCRIPTION	Page
!RIBBON	Check Ribbon Type	2-125
!RLEVEL	Check Patches Remaining	
!SB	Check Stand-By Mode Settings	2-135
%SERIE	Get Printer Serial Number	2-139
%HEAD	Get Print Head Serial Number	2-57
!SERIE	Get Laminator Serial Number	2-138
!SIDE	Check Laminator Mode	2-141
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!V	Return Operational Parameter	2-150
!W	Move Card Backward 8 cm	2-153
!X	Check Command Initiator	2-158
Image Data Download Commands		
B/vB	Write Bar Code	2-14
C/vC	Write Box (Monochrome)	2-38
D/vD	Draw Diagonal Line (Monochrome)	2-45
G/vG	Initialize Monochrome Graphic (B/W)	2-56
GS	Download Color Graphic	2-55
$L	Draw a Horizontal Line/Rectangle in a Color Buffer	2-71
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O/vO	Load Single Line Bitmap (Monochrome)	2-108
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!M	Move Print Head Up	2-82
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MC	Clear Media Path	2-84
MCL	Move Contactless	2-85
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MF	Flip Card	2-87
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MIB	Move Card Back to Print Ready Position	2-89
MM	Move Card Through Printer	2-90
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MRB	Move Card to Reject Box	2-94
MS	Move Card to Smart Card Programmer	2-96
!P	Move Card Forward 8 cm	2-111
SF	Synchronize Film (Overlaminate)	2-140
&T	Magnetic Encoder Card Eject	2-144

A - Print Test Card

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Prints a Standard Test Card with Printer Parameters, Version Number, and Test Pattern. Systems with Laminators print two cards—one for the Printer the other for the Laminator (if connected).

Syntax `<Esc>A{ p₁}`

Parameters p_1 = Test Card

Where:
    None =
        Standard Test Card(s)
    1 = Printer Test Card
    2 = Magnetic Encoder Test Card
    3 = Lamination Test Card

Figure 2-2 Standard Monochrome Test Cards

Figure 2-3 Standard Color Test Cards

Figure 2-4 Printer and Laminator Card Sides

!AO - Check Patch Sensors

Models Supported	P520c, P520i, P720c
Description	Returns values for selected laminator patch position sensor
Syntax	$<Esc>$#-1-!AO p_1\{ p_2\}
Parameters	p_1 = Card Side

Where:
    0 = Upper laminator patch position sensors
    1 = Lower laminator patch position sensors

p_2 = laminator patch position sensor selection

Where:
    None = Default settings
    0 = X-Axis Sensor
    1 = Y-Axis Sensor

!AT - Check Heat Offset

Models Supported   P520c, P520i, P720c

Description   Returns any variation from the Factory Set Laminator Roller Heat. For example, for a Factory Setting of 180° and a Roller Heat of 190°, the !AT Command returns a +10.

Syntax   `<Esc>#-1-!AT p`$_1$

Parameters p_1 = Roller Selection

Where:
   0 = Top Heat Roller
   1 = Bottom Heat Roller

ATM - Set Card Feeding Mode

Models Supported   P110i, P120i, P330i, P430i

Description   Select card feeding mode and control how printer reacts to an out-of-card condition.

Syntax   <Esc>ATM p_1

Parameters p_1 = Feed Mode as follows:

0 = Normal mode (default). This mode is intended for use with printers equipped with a card feeder hopper. When the hopper is empty, the printer will signal that it is out of cards and wait for the user to add more. The printer will not enter a ready state (and resume printing) until the error state is cleared by pressing the <select> button.

1 = ATM Mode (default). This mode is intended for use with printers equipped with a front single-card feeding slot. In this mode, the printer will signal that it is out of cards as mode 0 does, but will automatically clear this error status when a card is fed in; the user does not have to press <select> to clear the error.

ATM mode, when enabled, is most effective when used in conjunction with an enabled card feed sensor (controlled by the FS command).

&B - Load Magnetic Encoder Track Write Buffer

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Load data into the write buffer for a single selected track of encoding

Syntax   <Esc>&B p$_1$ *data*

Parameters   p$_1$ = Track Number and data format

Where:
   1 = Track 1 ASCII data
   2 = Track 2 ASCII data
   3 = Track 3 ASCII data
   11= Track 1 hexadecimal data*
   12= Track 2 hexadecimal data*
   13= Track 3 hexadecimal data*

data =
   Each track has unique character and length limitations due to formatting, and each has its own data buffer. When <p1> = 1..3, <data> should be expressed as a simple string of ASCII characters. If <p1> = 11..13, <data> should be expressed as a variable length sequence of 2-digit ASCII hexadecimal numbers.

   In hex mode, only digits 0..9 and uppercase alpha characters A..F are allowed. No error checking is performed on the <data> field; the data loaded into the track write buffer will be indeterminate if the <data> string contains invalid characters. The printer automatically inserts the required ISO Control Characters (start and stop sentinel, longitudinal redundancy check character, etc.) into the data.

The actual data encoded onto the card is converted from ASCII to an ISO track-specified encoding format. See Appendix C for default ANSI/ISO data formats and custom data encoding commands.

Track	Characters (Default ANSI/ISO)	Field Separator	Length
1	<Sp> $ ( ) - . / 0 through 9 A through Z (All Caps)	^	76
2	0 through 9	=	37
3	0 through 9	=	104
11*	Hexadecimal	N/A	*
12*	Hexadecimal	N/A	*
13*	Hexadecimal	N/A	*
* - See Appendix C for Extended Encoder Command Set and Custom Track Data and Control Parameters.			

+B - Serial Interface Rate

	The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. Printers with parallel interfaces cannot respond to this command, (other than flagging an error). In a test environment, card printers can operate with both interfaces attached and communicating with the printer. The printer CPU board has associated connectors.

Models Supported   P205, P210i, P310c, P310f, P310i, P420c, P420i

Description   This command changes the bit rate (Baud) of printers with RS232 serial interfaces. RFID-equipped models may not offer the RS232 option.

NOTE: Baud setting remains in effect until power is cycled, after which printer returns to default.

Syntax   `<Esc>+B p`$_1${ `p`$_2$}

Parameters p_1 = Serial Interface baud rate options

Where:
   0 = 9600 (Default)
   1 = 19200
   2 = 38400
   3 = 57600

p_2 = Command reply time

Where:
None = ACK after Baud switch
1 = ACK before Baud switch

+BS - Set Black Synchro

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Sets the accuracy of card positioning, when set to high quality, the printer print positioning is more accurate.
Syntax	`<Esc>+BS` p_1
Parameters	p_1 = Speed

Where:
    0 = High speed printing
    1 = High quality printing

B/vB - Write Bar Code

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	This command downloads standard bar codes. See Appendix A for character maps and unique parameter settings for each bar code type. The B command writes to the monochrome buffer, while the vB command writes to the varnish buffer.
Syntax	`<Esc>B` p_1 p_2 p_3 p_4 p_5 p_6 p_7 p_8 *data*
Parameters	p_1 = Horizontal (X-axis) Start Position, in dots

p_2 = Vertical (Y-axis) start position, in dots

p_3 = Rotation:

Where:

Value	Description	Origin
0	No rotation	Lower Left
1	90 degrees	Lower Left
2	180 degrees	Lower Left
3	270 degrees	Lower Left
4	No rotation	Centered
5	90 degrees	Centered
6	180 degrees	Centered
7	270 degrees	Centered

Figure 2-5
Bar Code Rotation
Samples

p_4 = Bar Code selection - See Appendix A

Where:
- 0 = Code 39 (3 of 9—Alphanumeric)
- 1 = 2/5 Interleaved (Numeric, Even No Count
- 2 = 2/5 Industrial (Numeric) no Check Digit
- 3 = EAN8 (Numeric, 12 digits encoded)
- 4 = EAN13 (Numeric, 12 digits encoded)
- 5 = UPC - A (Numeric, 12 digits encoded)
- 6 = Reserved for MONARCH
- 7 = Code 128 C w/o Check Digits* (Numeric only, Even Number Printed)
- 8 = Code 128 B w/o Check Digits* (Alphanumeric)
- s

107 = Code 128 C w/Check Digits*
   (Numeric only, Even Number printed)
108 = Code 128 B w/Check Digits*
(Alphanumeric)

* Not supported in some Monochrome Printerp$_5$ = Bar Width Ratio
Where:

Value	Narrow Bar	Wide Bar	Ratio
0	1 dot	2 dots	2:1
1	1 dot	3 dots	3:1
2	2 dots	5 dots	2.5:1 or 2:5

NOTE: Some bar code types have a selectable bar code width ratio. See Appendix A for supported ratio and settings.

p_6 = Bar Code Bar Width Multiplier. Range 3~9 for all Zebra card bar codes except UPC-A, EAN-8 and EAN-13 which have a range of 4~7. For a selected bar width ratio of 2:5, the range is 2~4.

Note: Each bar code type has a specified standard for the width range of a narrow bar width. See Appendix A for optimal values.

p_7 = Bar Code Height in dots

Note: Each Bar Code Type has an industry specified minimum height standard. See Appendix A for optimal values.

p_8 = Print Text version of Bar Code under Bar Code

Where:
   1 = yes
   0 = no.

data =
   Represents a fixed data field. Each bar code type has a differing data field length and allowable character requirements. See Appendix A.

A printer error occurs when a bar code extends beyond the addressable area of the image buffer. See Appendix A for field size calculations for total bar code length and height.

&C - Set Coercivity

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   This command sets the encoder for high- or low-coercivity magnetic stripe recording.

Syntax   <Esc>&C p_1

Parameters p_1 = Coercivity

Where:
  0 = Low
  1 = High

+C - Adjusts Monochrome Intensity

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Sets the monochrome ribbon transfer intensity (heat) level. Varying the intensity level affects the dot gain, or the size of the dot and the density (opaqueness) of the transferred material. note that higher values raise the transfer heat.

Syntax   <Esc>+C p_1

Parameters p_1 = Intensity

Where:
5 = Printer default
0~10 = range

+$C - Adjust Color Contrast

Models Supported P110i, P120i, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Sets the range from the maximum to minimum color intensity (heat) level applied to a selected dye sublimation ribbon panel

Syntax `<Esc>+$C` p_1 p_2

Parameters $p_1 = 4$: Set contrast for all colors (0 - 3)

Where:
  0 = Yellow (Y)
  1 = Magenta (M)
  2 = Cyan ©)
  3 = Dye Sublimation Black (K_{dye})

p_2 = Contrast:

Where:
  5 = Printer default
  0~10 = p_2 range

!CC - Get Number of Cards Printed

Models Supported   P110i, P120i, P210i, P310i, P320i, P330i, P420i, P430i, P520i

Description   Every time the printer finishes printing an entire card, it increments its cards printed counter. This counter is saved in non-volatile memory. This command will return the total number of cards that have been printed since the printer entered service. The value is reported to the host as an ASCII decimal number.

Syntax   `<Esc>!CC`

Parameters   None

!CCLN - Check Cleaning Parameters

Models Supported   P720c

Description   Returns Card Count and Maximum Heat Values set by the +CCLN Command

Syntax   <Esc>#-1-!CCLN

Parameters   None

+CCLN - Set Cleaning Parameters

Models Supported	P720c
Description	Establishes lamination count and maximum temperature value for laminator cleanings
Syntax	`<Esc>#-1-+CCLN` p_1 p_2
Parameters	p_1 = Number of cards laminated
	p_2 = Temperature below which cleaning is allowed
Default	`+CCLN 1000 60`

%CDER - Get Magnetic Encoder Read Settings

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Returns the magnetic encoder read settings that are presently in effect, as set by the &CDER command. The string returned is formatted like this:

"TRACK 1"* "TRACK 2"# "TRACK 3"*

where * and # are substituted with the decode settings that take the same form as those used by the &CDER command. the example below shows the string that would be returned if tracks 1 and 3 were set to the default ISO decode settings, and the settings for track 2 had been changed by executing the command: &CDER 2 V 6 :

"TRACK 1"A "TRACK 2"V 6 "TRACK 3"C

Syntax   <Esc>%CDER

Parameters   None

&CDER - Set Magnetic Encoder Track Read Encode Parameters

	The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. The card printer cannot respond to this command, (other than flagging an error), through a parallel interface. In a test environment, card printers can operate with both interfaces attached and communicating with the printer. The printer CPU board has associated connectors.

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Set the encoder to read a selected data format

Syntax <Esc>&CDER p_1 p_2
<Esc>&CDER p_1 p_2

Parameters p_1 = Track Select: (values 1, 2, 3, or 0 (zero)

Where:
0 = Reset of ALL tracks to ISO default
configuration parameters

p_2 = Custom Data Select, as follows:

Value	Description - ISO Format Data
0	Resets ALL tracks to ISO default configuration parameters.
Default Format Select	
Q	ISO Track 1 Data Format to Track 1
R	ISO Track 2 Data Format to Track 2
S	ISO Track 3 Data Format to Track 3
Custom ISO Track Format Location	
qX	Track 1 with ISO Track "X" Format
rX	Track 2 with ISO Track "X" Format
sX	Track 3 with ISO Track "X" Format
X = 1, 2, or 3 as the ISO default track format applied to the selected track (e.g., Q=q1, R=r2, and S=s3.	

p_2 = Custom Data Select, as follows:

Value	Description - Raw Data Format
Read Forward - "Raw" Data	
U	Track 1
U_	Track 1 read data with NULs in data string
V	Track 2
V_	Track 2 read data with NULs in data string
W	Track 3
W_	Track 3 read data with NULs in data string
Read Reverse - "Raw" Data	
u	Track 1
u_	Track 1 read data with NULs in data string
v	Track 2
v_	Track 2 read data with NULs in data string
w	Track 3
w_	Track 3 read data with NULs in data string

p_3 = Data Block Size Select in Bits

Where:
Acceptable values = 3, 4, 5, 6, and 7

The encoder cannot decode and convert raw data into ASCII data. The encoder only reports data read after the process has completed.

&CDEW - Set Magnetic Encoder Track Write Encode Parameters

	The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. The card printer cannot respond to this command (other than flagging an error) through a parallel interface. In a test environment, card printers can operate with both interfaces attached and communicating with the printer. The printer CPU board has associated connectors.

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Configure the write data to encode a single, selected track of data

Syntax   <Esc>&CDEW p_1 p_2
<Esc>&CDEW p_1 p_2 p_3

Parameters p_1 = Track Select: (values 1, 2, 3 or 0 (zero)

Where:
   0 = Reset of ALL tracks to ISO default
       configuration parameters

p_2 = Data Format Select, as follows:

Value	Description - ISO Format Data
0	Reset ALL tracks to ISO default configuration parameters.
Default Format Select	
A	ISO Track 1 Data Format to Track 1
B	ISO Track 2 Data Format to Track 2
C	ISO Track 3 Data Format to Track 3
Custom ISO Track Format Select	
aX	Track 1 with ISO Track "X" Format
bX	Track 2 with ISO Track "X" Format
cX	Track 3 with ISO Track "X" Format
X = ISO default track format applied to the selected track (e.g., A=a1, B=b2, and C=c3.	

p_2 = Custom Data Select, as follows:

Value	Description - Raw Data Format
Read Forward - "Raw" Data	
E	Track 1
E_	Track 1 write data with NULs in data string
F	Track 2
F_	Track 2 write data with NULs in data string
G	Track 3
G_	Track 3 write data with NULs in data string

p_3 = Data Block Size Select in Bits

Where:
Acceptable values = 3, 4, 5, 6, and 7

The encoder cannot encode and convert ASCII data into raw data. The encoder only reports that a data write process has completed.

+CDOTS - Image Print Quality Compensation Factor

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Card design elements that run the length of a card side can sometimes appear with density variations. An ID badge containing a portrait and a solid, card length, bar at a side can exhibit these variations.

Any changes should occur in small increments followed by card prints using trial-and-error as a basis. Zebra Technical Support guidance is recommended.

Syntax	<Esc>CDOTS $p_1\{\ p_2\}$
Parameters	p_1 = Compensation Factor (0 ~ 50)
	Where:
	0 = No change
	1 ~ 50 = Compensation factor
	p_2 = 1 = Return current compensation factor

+CH - Adjust Hologram Intensity

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Sets the hologram material transfer intensity (heat) level. Varying the intensity level affects the dot gain or size of the dot and the density (opaqueness) of the transferred material.

Syntax   <Esc>+CH p_1

Parameters p_1 = Intensity

Where:
    5 = Printer default
    0~10= range

CHECK - Return Checksum

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Returns firmware checksum value

Syntax   `<Esc>CHECK`

CLEAN - Set Cleaning Card Sequence

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   This command requires the prior removal of any ribbon and all cards except for a single Cleaning Card. The following occurs:
- Raise Print Head
- Feed a card to a position under Print Head
- Lower Print Head
- Move card back and forth the number of times specified by CLNCARD Command
- Raise Print Head
- Exit card

Non P720 Syntax   `<Esc>CLEAN`

Non P720 Parameters   None

P720 Syntax   `<Esc>CLEAN` p_1

P720 Parameters p_1 = Station Cleaned

Where:
1 = Printer
2 = Magnetic Encoder Head
3 = Printer and Laminator (this command will be ignored)
4 = Laminator (this command will be ignored)

!CLEAN - Clean the Laminator

Models Supported   P720c

Description   This command will clean the laminator on the P720c printer

Parameters   None

Syntax   `<Esc>+CLEAN`

%CLN - Check Due-for-Cleaning Parameters

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Reports current values for the printing, cleaning and cleaning pass counters

Syntax (sent) `<Esc>%CLN`

Syntax (received) `Cpt imp:p_1 next clean Prn:p_2 nb pass:p_3`

Where:
p_1 = Total number of Head-down Image Passes made by printer since new (note that each ribbon panel used counts as a pass)

p_2 = Current setting for image passes that trigger a cleaning alert (default = 00005000—see CLNCARD Command)

p_3 = Current setting for passes performed using Cleaning Card (default = 5—see CLNCARD Command)

Example `Cpt imp:00025000 next clean Prn:00005000 nb pass:5`

CLNCARD - Set Cleaning Parameters

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Allows settings for a Time-to-Clean Alert and the cycling of cleaning card in Card Path
Syntax	`<Esc>#-1-CLNCARD` p_1 p_2
Parameters	p_1 = Ribbon Panel Count to Cleaning Notification (Default = 5000)
	p_2 = Number of Cleaning Card Passes Through Printer (Default = 5)

CRB - Set Reject Box Card Count Warning Threshold

Models Supported   P420c, P420i, P430i, P520c, P520i, P720c

Description   P420, P520, and P720 Printers have a counter that keeps track of the number of cards sent to the Rejected Card Box. This command allows selection of a card count that produces the REJECTED BOX FULL message on the LCD. Note that, after removing the cards, users press the Panel Button. For this command, release of the Panel Button resets the counter. The box can safely hold twenty 30-mil cards, and P420, P520, and P720 Printers ship with this setting. Users of less thick cards may wish to increase the count.

Syntax   `<Esc>CRB` p_1

Parameters p_1 = Reject Box card count warning threshold

Where:
    10 = Default

!CT - Check Cooling Time

Models Supported	P720c
Description	Returns the Transition Time Setting for cards passing between the Lamination Rollers and the Output Hopper
Syntax	`<Esc># 1 !CT{ p`$_1$`}`
Parameters	p_1 = Default, if p_1 is other than 0

+CT - Set Cooling Time

Models Supported   P720c

Description   Adjusts the transition time for cards passing between the lamination rollers and the output hopper

Syntax   `<Esc># 1 +CT` p_1

Parameters p_1 = Cooling time in seconds

Where:
   Default = 0

+CV - Adjust Clear Varnish Intensity

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Sets the clear veneer ribbon transfer intensity (heat) level. varying the intensity level affects the density (amount) of the transferred material.

Syntax   `<Esc>+CV` p_1

Parameters p_1 = Intensity

Where:
    5 = Default
    0~10 = Range

C/vC - Write Box (Monochrome)

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Writes a hollow-box rectangle graphic to the monochrome image buffer by defining the height, width, line thickness (width) and origin. The C command writes to the buffer used for resin printing. The vC command writes to the buffer used for varnish printing.

Syntax <Esc>C p_1 p_2 p_3 p_4 p_5 p_6
<Esc>vC p_1 p_2 p_3 p_4 p_5 p_6

Parameters p_1 = Horizontal (X-axis) start position in dots

p_2 = Vertical (Y-axis) start position in dots

p_3 = Horizontal (X-axis) width of graphic line in dots (i.e. horizontal lines)

p_4 = Vertical (Y-axis) height of graphic line in dots

p_5 = Thickness/width of diagonal graphic line in dots

p_6 = Graphic Mode

Where:
0 = Reverse Bit Map—Clear Print Area and load Reverse Bit Map Image
1 = Standard Bit Map—Clear Print Area and load Bit Map Image
2 = Merge Bit Map—Overwrite Background Bit Map Image with Printable Dot Locations, leaving Non-printing Dot Locations alone

Figure 2-1
Hollow Box
Image Positioning

Lines

0

Dots

p5

Hollow Box
Image Origin
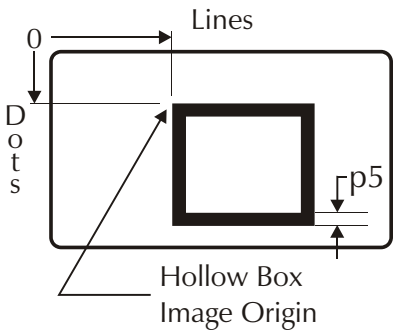
!D - Move Print Head Down

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Moves the Print Head assembly down to the card (and platen roller)
Syntax	`<Esc>!D`
Parameters	None

&D - Change Track Density

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. Printers with parallel interfaces cannot respond to this command, (other than flagging an error). In a test environment, card printers can operate with both interfaces attached and communicating with the printer. The printer CPU board has associated connectors.

Models Supported   P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P520c, P520i, P720c

Description   Changes the data encoding and decoding density of an individual track

Syntax   `<Esc>&D` p_1 p_2

Parameters p_1 = Track Select, as follows:

Where:
   1 = Tracks 1 and 3
   2 = Track 2
   3 = Tracks 1 and 3

p_2 = Density Select, as follows:

Where:
   75 = 75 bpi
   210 = 210 bpi

+DLAMI - Set Lamination Configuration

Models Supported   P520c, P520i

Description   Enables or disables print station varnish or laminator station lamination. The associated application occurs with issuance of an IV command, or in some instances, an I command (In the following examples, look for the +DLAMI that precedes an I or IV)

NOTE 1: This command applies to printer and, therefore, requires no <Esc>#<Sp>1 preface.

Syntax   `<Esc>+DLAMI p`$_1$` p`$_2$

Parameters p_1 = Print station varnish

Where:
    0 = Disable
    1 = Enable

p_2 = Laminator

.000n

Where:
    0 = Disable
    1 = Enable
    2 = Enable and flip to laminate (applies to YMCKO and YMCK ribbons to laminate the color side after imaging K_{resin} on the monochrome side)

Examples Using YMCKO Ribbon   Print YMCK on both sides then laminate first side:

+DLAMI 0 1	Laminate enabled (side-1 default)
IS 0	Print Y (side 1)
IS 1	Print M (side 1)
IS 2	Print C (side 1)
I	Print K (side 1)
IV 10	No varnish, just a return
MF	Flip Card & return
+DLAMI 0 0	Disable both varnish & lamination
IS 0	Print Y (side 2)
IS 1	Print M (side 2)
IS 2	Print C (side 2)
I	Print K (side 2)
IV	Flip card, laminate, eject (no varnish)

+DLAMI - Set Lamination Configuration (Continued)

On first side, print YMCK then laminate. On second side, print YMCKO panels (no laminate):

+DLAMI 0 1	Laminate enabled (side-1 default)
IS 0	Print Y (side 1)
IS 1	Print M (side 1)
IS 2	Print C (side 1)
I	Print K (side 1)
IV 10	No varnish, just a return
MF	Flip Card & return
+DLAMI 1 0	Varnish enabled
IS 0	Print Y (side 2)
IS 1	Print M (side 2)
IS 2	Print C (side 2)
I	Print K (side 2)
IV	Print O (side 2), flip, laminate, & eject

Print all ribbon panels on both sides without lamination:

+DLAMI 1 0	Varnish enabled
IS 0	Print Y (side 1)
IS 1	Print M (side 1)
IS 2	Print C (side 1)
I	Print K (side 1)
IV 10	Print O (side 1) & return
MF	Flip Card & return
+DLAMI 1 0	Varnish enabled
IS 0	Print Y (side 2)
IS 1	Print M (side 2)
IS 2	Print C (side 2)
I	Print K (side 2)
IV	Print O (side 2) & eject)

Examples Using YMCKOK Ribbon

On first side, print YMCK panels then laminate. On second side, print last K panel then laminate:

+RIB 10	YMCKOK ribbon in use
+DLAMI 0 1	Laminate enabled (side-1 default)
IS 0	Print Y (side 1)
IS 1	Print M (side 1)
IS 2	Print C (side 1)
I	Print K (side 1)
IV 10	No varnish, just a return
MF	Flip Card
+DLAMI 0 0	Laminate enabled
I 20	Print K (side 2)
MO	Flip Card, Laminate, & Eject

On first side, print YMCK panels then laminate. On second side, print just last K panel:

+RIB 10	YMCKOK ribbon in use
+DLAMI 1 0	Laminate enabled (side-1 default)
IS 0	Print Y (side 1)
IS 1	Print M (side 1)
IS 2	Print C (side 1)
I	Print K (side 1)
IV 10	No varnish, just a return
MF	Flip Card & return
+DLAMI 0 0	Varnish enabled
I 20	Print K (side 2) & return
MO	Flip card, laminate, & eject

On first side, print YMCKO panels (no lamination). On second side, print just last K panel (No lamination):

+RIB 10	YMCKOK ribbon in use
+DLAMI 1 0	Varnish enabled
IS 0	Print Y (side 1)
IS 1	Print M (side 1)
IS 2	Print C (side 1)
I	Print K (side 1)
IV 10	Print O & return
MF	Flip Card & return
+DLAMI 1 0	Varnish enabled
I 20	Print K (side 2) & return
MO	Eject card

Examples Using $K_{dye}O$ Ribbon

Print K_{dye} and laminate K_{dye} on side two:

+DLAMI 0 1	Laminate enabled (side-1 default)
IS 3	Print K (side 1)
IV 10	No varnish, just a return
MF	Flip Card & return
+DLAMI 0 0	Disable both varnish & laminate
IS 3	Print K (side 2)
IV	Flip card, laminate, & eject

+DLAMI - Set Lamination Configuration (Continued)

On first side, print K and laminate. On second side, print K and varnish:

```
+DLAMI 0 1   Laminate enabled (side-1 default)
IS 3         Print K (side 1)
IV 10        No varnish, just a return
MF           Flip Card & return
+DLAMI 1 0   Varnish enabled
IS 3         Print K (side 2)
IV           Print O, flip card, & laminate
```

Print $K_{dye}O$ on both sides without lamination:

```
+DLAMI 1 0   Varnish enabled
IS 3         Print K (side 1)
IV 10        Print O (side 2) & return
MF           Flip Card & return
+DLAMI 1 0   Varnish enabled
IS 3         Print K (side 2)
IV           Print O (side 2) & eject
```

Examples Using Monochrome Ribbon

Print K and laminate side one:

```
+DLAMI 0 1   Laminate enabled (side-1 default)
I 10         Place at print ready
MF           Flip Card & return
+DLAMI 0 0   Disable both varnish & laminate
I            Print K, flip card, laminate eject
```

On first side, print K and laminate. On second side just print K:

```
+DLAMI 0 1   Laminate enabled (side-1default)
I 10         Print K (side 1),  & return
MF           Flip Card & return
+DLAMI 0 1   Varnish enabled
I            Print K, flip card, & eject
```

Print K on both sides without lamination:

```
+DLAMI 1 0   Varnish enabled
I 10         Print K & return
MF           Flip Card & return
+DLAMI 0 0   Disable both varnish & laminate
I            Print K & eject card
```

D/vD - Draw Diagonal Line (Monochrome/Overlay)

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Write a monochrome diagonal line graphic by defining the total height, total width, line thickness (width) and position in the Monochrome Image Buffer. The "D" Command writes to the Resin buffer, and the "vD" command writes to the Varnish buffer. The actual image placed is a rectangle.

Syntax   <Esc>D p_1 p_2 p_3 p_4 p_5 p_6 p_7

Parameters p_1 = Horizontal (X-axis) Start Position, in dots

p_2 = Vertical (Y-axis) Start Position, in dots

p_3 = Horizontal (X-axis) Width of Graphic, in dots

p_4 = Vertical (Y-axis) Height of Graphic, in dots

p_5 = Thickness/width of the Line, in dots

p_6 = Rotation & Origin

Where:

Value	Description	Origin
1	90 degrees	Lower Left
2	180 degrees	Lower Left

p_7 = Graphic Mode:

Where:
- 0 = Reverse Bit Map—Clear Print Area and load Reverse Bit Map Image
- 1 = Standard Bit Map—Clear Print Area and load Bit Map Image
- 2 = Merge Bit Map—Overwrite Background Bit Map Image with Printable Dot Locations, leaving Non-printing Dot Locations alone

Figure 2-2
Diagonal Line Values
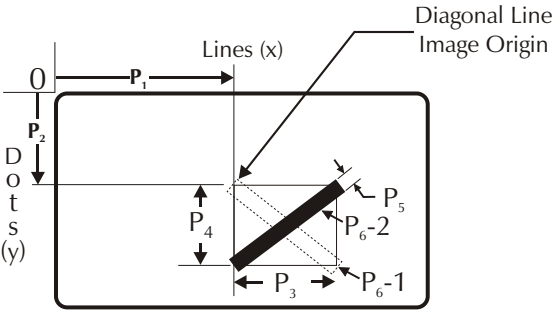
E - Retransmit Last Response

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. Printers with parallel interfaces cannot respond to this command, (other than flagging an error). In a Test Environment, card printers can operate with both interfaces attached and communicating with the printer. The Printer CPU Board has associated connectors.

Models Supported   P110i, P120i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Models Supported   This command directs the printer to repeat the last Status Message.

Syntax   `<Esc>E{ p`$_1$`}`

Parameters p_1 = Port selection/mode

Where:
- 1 = Parallel Port in Reverse Serial mode (allows host to pull serialized data from printer over the Parallel Port—please contact Technical Support for related information).
- 2 = Use USB Port. Update Printer Output Buffer with response to commands received.

&E - Write Single Track

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Encode, write and read (verify) a single track of data.
	The printer feeds a card (if a card is not loaded) and magnetically writes data to the selected ISO Track. The card automatically read-verifies the encoded data. The card then moves to the print-ready position.
Syntax	`<Esc>&En data` `<Esc>&e n data`
Parameters	p_1 = Encoding Track Number (1~3)
	data = ISO track
	n = track #
	The <data> field is optional; if it is omitted, the data last loaded into the mag encoder write buffer for track <p1> will be written to the specified track. If a <data> field is specified, it overwrites any previous data in the track write buffer; the new data provided is used in the subsequent track write operation. The format of the <data> parameter is an ASCII string, following the same conventions as those that apply to the <data> field for the &B (Load Mag Encoder Track Write Buffer) command.

The actual data encoded onto the card is converted from ASCII to the encoding format previously specified for the associated ISO card track. See Appendix C for default ANSI/ISO data formats and custom encoding commands.

&E* - Write Track Buffers

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Encodes, Writes, and Reads (verifies) for all tracks of data stored in Printer Memory.

The printer positions a card at the Encoder Station and magnetically writes data (previously entered in memory) to the pre-selected ISO track(s). If no card is present in the Card Path, a card is sent from the Card Feeder. Following the Encoder Write Operation, the card returns to the Write-Ready Position, and a read-verification of Encoded Card Data follows. The card then travels to the Print-Ready Position, and an Encoder Data Buffer Clear occurs in preparation for the next operation.

Syntax `<Esc>&E*`

Parameters None

+EC - End of Print

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Specifies a point, beyond which, no card printing occurs. Print stations have storage for 1030 lines of imaging, which exceeds the x-axis image area on the cards.

The parameter for end of print causes the print head to raise at the end-of-card point, not the end of data. If left down beyond the end of card, the print head can shear the ribbon as the print head abruptly drops below the surface of the card. Note that higher values of p_1 result in shortened line counts.

Note that the print direction of P205/P210 engines is the opposite of other engines. In all engines, EC offsets shorten the bitmap at the end of the printed area. Therefore, EC increases shorten the left side of P205/P210 images and the right side of other printer images.

Syntax `<Esc>+EC` p_1

Parameters p_1 = line count for end-of-print

Where:
10 = default (standard)
0~48 = range

Example The following example sets the End of Print to 10 (the default value).

`<Esc>+EC 10`

$F - Clear Color Image Buffers

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Clears the yellow, cyan, and magenta color panel image buffers to the default (all pixels off) state.

Syntax   `<Esc>$F`

Parameters   None

!FF - Set Ribbon Color Sequence

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Resets and moves the ribbon to a selected panel

The printer first aligns on the Cyan (and Black) Panels and then counts ribbon panel positions from the Yellow "0" Panel.

Syntax   <Esc>!FF p_1

Parameters p_1 = Panel detection number

The P330i and P430i printers will respond to !FF 0 only. Any other parameter will cause the ribbon to continuously feed.

Where:

p_1 = 0 Moves ribbon to Sync Position, as follows:

Ribbon	Sync Position
YMC	Yellow Panel
$YMCK_{resin}$	Yellow Panel
$YMCK_{resin}O$	Yellow Panel
$YMCK_{resin}OK_{resin}$	Yellow Panel
$K_{dye}O$	Mid Overlay Varnish
$K_{resin}O$	Mid Overlay Varnish

p_1 = 1 Moves ribbon to next Transparent Panel, unless already there. For P210, moves ribbon to next panel.

p_1 = 2 Moves ribbon to next Non-transparent Panel, unless already there. For P210, moves ribbon to next panel.

p_1 = 3 Moves ribbon to beginning of Black (for $YMCK_{resin}O$ ribbons only)

$FP - Clear Specified Bit-Maps

Models Supported P110i, P120i, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Allows Memory Clears of areas reserved for specified colors

Syntax `<Esc>$FP` p_1

Parameters p_1 = Buffer Area Cleared

Where:
> 0 = Yellow
> 1 = Magenta
> 2 = Cyan
> 3 = Dye Black (Using $K_{dye}O$ Ribbon)

FS - Control Use of Card Feed Sensor

Models Supported   P330i, P430i

Description   The printer provides a sensor located near the card feed slot that can detect when a card has been inserted into the slot by the user. When the card feed sensor is enabled (and the 'ATM' feature is enabled - see ATM command) the printer can accept a card fed by the user without requiring the user to actually start a print job on the host or press a button on the printer - the printer accepts a card for printing in much the same way that a ATM machine accepts a card, hence, "ATM mode".

In some environments, it may be preferable to have the printer act like earlier single card models, where the printer card feed mechanism is activated when a print job is started, rather than the mere presence of a card in the card feed slot. This command, in conjunction with the "ATM" command, controls how the printer handles card feeding..

Syntax   <Esc>FS P$_1$

Parameters   P$_1$ = Card feed sensor monitor

0: Sensor disabled. User must start a print job before the printer will accept a card.

1: Sensor enabled. Printer will automatically feed a card presented at the card feed slot into the print mechanism (assuming that a card has not already been fed in).

F/vF - Clear Monochrome Image Buffers

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Clears Monochrome Image Buffers of bit-maps and printable data (lines, text, bar codes, etc.)

Syntax `<Esc>F`

Parameters None

GS - Download Color Graphic

Models Supported	P110i, P120i, P210i, P310c, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Initializes, downloads, and positions individual color-separated data (C,M,Y, or K) for a partial image. Defines the height, width and position of the graphic.
Syntax	`<Esc>GS` p_1 p_2 p_3 p_4 p_5 p_6 *data*
Parameters	p_1 = Color Image Buffer Number

Where:
>   0 = Yellow (Y)
>   1 = Magenta (M)
>   2 = Cyan ©)
>   3 = Dye Sublimation Black (Ks)

p_2 = Data Mode:

Where:
>   32 = Uncompressed Data - 256 levels
>   (00~FF Hex.)
>   30 = Compressed Data - 32 levels (00-1F Hex.)

p_3 = Horizontal (X-axis) Start Position, in dots

p_4 = Vertical (Y-axis) Start Position, in dots

p_5 = Horizontal (X-axis) Width of graphic, in dots (i.e. horizontal lines)

p_6 = Vertical (Y-axis) Height of graphic, in bytes

data =
>   Uncompressed or compressed color bit-map data for a single separated color

G/vG - Initialize Monochrome Graphic (B/W)

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Initializes Monochrome Graphic Area using height, width and position

Syntax   `<Esc>G` p_1 p_2 p_3 p_4 p_5 p_6

Parameters p_1 = Horizontal (X-axis) Start Position (X) in dots

p_2 = Vertical (Y-axis) Start Position (Y) in dots

p_3 = Download Mode for Graphic (Bit-map):
When using bytes, the byte count must be rounded upward to the next nearest whole byte.

Example:
25 dots = 3 bytes + 1 dot = 4 bytes

Value	Data	Description
0	Byte	Standard
1	Byte	Standard with Checksum
2	Byte	Compressed
3	Byte	Compressed with Checksum
10	Dot	Standard
11	Dot	Standard with Checksum
12	Dot	Compressed
13	Dot	Compressed with Checksum

p_4 = Vertical (Y-axis) Height of graphic in bytes.
Round up the number of bytes loading in multiples of 8 bits (i.e. Monochrome Dots)

p_5 = Horizontal (X-axis) Width of graphic in dots (i.e. horizontal lines)

p_6 = Graphic Mode:

Where:
0 = Reverse Bit Map—Clear Print Area and load
Reverse Bit Map Image
1 = Standard Bit Map—Clear Print Area and load
Bit Map Image
2 = Merge Bit Map—Overwrite Background Bit
Map Image with Printable Dot
Locations,
leaving Non-printing Dot
Locations alone

%HEAD - Get Print Head Serial Number

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Both the printer as a whole and the print head subassembly are assigned a unique serial number after passing post-manufacturing quality and functional tests. The serial number assigned to the print head mechanism is separate from that assigned to the printer as a whole. This command is used to retrieve the serial number assigned to the print head mechanism.
Syntax	<Esc>%HEAD
Parameters	None

I - Print Monochrome Panel

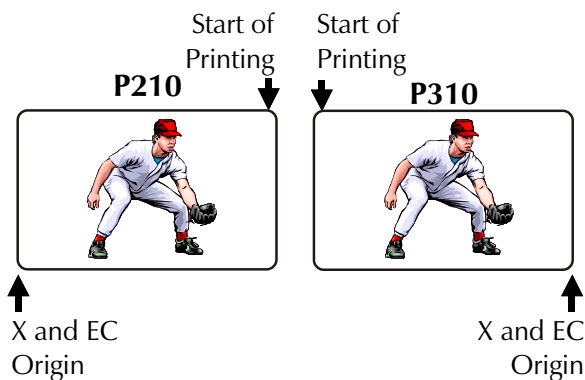**Models Supported**   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   This command serves to print a Monochrome Graphic Panel from a card image previously stored in the buffer designated for Resin images.

After print completion, the card may be ejected to the Output Hopper or repositioned to print another image (ribbon panel). Typically the Clear Varnish, or for some models, the Hologram Lamination prints next. Then, a duplex printer may produce additional printing after flipping the card to the opposite side.

Ribbon panels advance during printing, making the installed ribbon the overriding factor in choosing buffers for imaging.

Syntax   `<Esc>I{ p_1}`

Parameters p_1 = Optional Command Parameter

Where:
   None =
      Monochrome Buffer Print and card eject
   10 = Card Print and return to Print Ready Position
   20 = For Kr or Ks Ribbons—Prints card and returns card to Print Ready Position. When appropriate, synchronizes ribbon
      For P520s using YMCKrOKr Ribbon—Ejects card after last application of either Kr or laminate. A prior +DLAMI Command determines when the I 20 Command invokes lamination.
   30 = Print card but leave in place—used when next Station is BUSY.

P520 with KrO Ribbon Example:

I 20
IV
MF
I 20
IV
MO

IH - Print Hologram Overlay

Models Supported   P110i, P120i, P310c, P310f, P310i, P320i, P330i,
P420c, P420i, P430i, P520c, P520i

Description   This command serves to print the entire addressable
Varnish Image Buffer or to reverse print any image data
(line, rectangles, graphics, text, etc.) previously stored in
the Resin Image Buffer.

After printing is complete, the card may be ejected to the
Output Hopper or repositioned to print form subsequent
ribbon panels for models that support the duplex
printing.

The ribbon advances position a panel for printing after
completion of printing from the previous panel.

Syntax   <Esc>IH{ p_1}

Parameters p_1 = Optional Print Parameter

Where:
None =
Prints 100% of Image Buffer as Hologram
Lamination and ejects card

1 = Prints inverse of Image Data to card and
ejects card

10 = Prints card and returns card to Print-Ready
Position

IM - Print Color Test Card

Models Supported	P110i, P120i, P210i, P310c, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Prints a card with a Color Test Pattern
	NOTE: The K_{resin} panel is not used in this image.
Syntax	`<Esc>IM`
Parameters	None
Figure 2-3 Color Test Card	
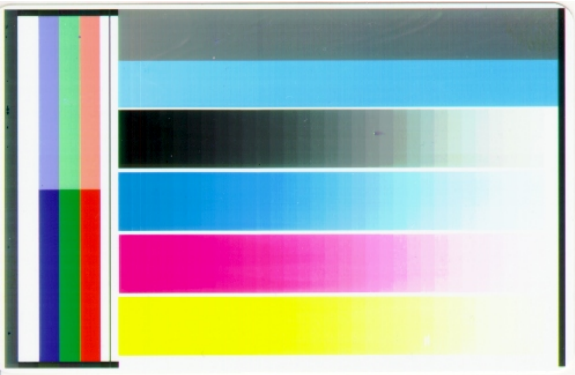
IMB - Print Gray Test Card

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Prints an all gray card. Typically this card serves as a basis for Print Head Adjustments. Note that a black ribbon is required (Reference table below).

Printer Model	Ribbon Required
P205 monochrome ribbon	800015-221
P210i monochrome ribbon	800015-201
P310c monochrome ribbon	800015-301
P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c monochrome ribbon	800015-101

Syntax   <Esc>IMB

Parameters   None

Figure 2-4
Print Black Test Card

IS - Print Card Panel

Models Supported   P110i, P120i, P210i, P310c, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   This command serves to print from a selected color dye sublimation ribbon panel using data from an associated image buffer.

After completing a printing pass, the card is repositioned to print the next ribbon panel.

The ribbon panel advances during printing such that completion of one panel leaves the ribbon ready to print the next panel.

NOTE: Printing for Dye Sublimation Black occurs using data from a color buffer in conjunction with a $K_{dye}O$ ribbon.

Syntax   `<Esc>IS p`$_1$

Parameters p_1 = Color image buffer number:

Where:
- 0 = Yellow (Y)
- 1 = Magenta (M)
- 2 = Cyan ©)
- 3 = Dye Sublimation Black (K_{dye})

NOTE: Card imaging using the YMCKOK ribbon requires the following command sequence:

IS 0	Image Yellow
IS 1	Image Magenta
IS 2	Image Cyan
I	Image Black and Return (YMCKOK only)
IV 10	Image Varnish and Return
I 20	Image Black and Return
MO	Eject Card

IV - Print Clear Varnish

Models Supported	P110i, P120i, P210i, P310c, P310i, P320i, P330i, P420c, P420, P430i
Description	This command serves either to print the entire addressable image buffer or to reverse print with the clear varnish or any image data (line, rectangles, graphics, text, etc.) previously stored in a Monochrome Image Buffer.
	After printing is complete, the card may be ejected to the Output Hopper or repositioned to print more ribbon panels for models that support the Hologram, Lamination, or Duplex Operations.
	The ribbon panels advance during printing such that completion of printing from one ribbon panel leaves the ribbon ready to print the next panel.
Syntax	`<Esc>IV{ p`$_1$`}`
Parameters	p_1 = Optional Print Parameter

Where:
None =
Print Varnish from all of Image
Buffer and
eject card
1 = Print Varnish using Inverted Image Buffer data and eject card
10 = Print card and return card to Print Ready
Position
11 = Print Varnish using Inverted Image Buffer
data and return card to Print
Ready Position
30 = Print card but leave in place (used when
next Station is BUSY
31 = Similar to 30, but inverts Image data

+ISC - Set Smart Card Serial Port Data Rate

Models Supported P330i, P430i

Description The Smart Card interface on the P330i printer provides an asynchronous communication port that can be used to communicate with an external smart card programming device. This command (or the more flexible +ISC2 variant) is used to configure the communication parameters used by the smartcard serial port.

Syntax `<Esc>+ISC` p_1

Parameters p_1 = Serial port baud rate, from the following table:
0=9600, 1=19200, 2=38400, 3=57600, 4=112500

The word size, parity and stop bit configuration of the smart card serial port are set to 8/None/1 when this command is used. Use the +ISC2 command if these parameters need to be changed.

+ISC2 - Set Smart Card Serial Port Data Rate (Advanced)

Models Supported	P330i, P430i
Description	The Smart Card interface on the P330i printer provides an asynchronous communication port that can be used to communicate with an external smart card programming device. This command (or the more basic +ISC variant) is used to configure the communication parameters used by the smartcard serial port.
Syntax	<Esc>+ISC2 p_1 p_2 p_3 p_4
Parameters	P_1 - Serial port baud rate, from the following table:
	0=9600, 1=19200, 2=38400, 3=57600, 4=112500
	P_2 - Parity setting: 0=Even, 1=Odd, 2=None
	P_3 - Word size: 5, 6, 7 or 8
	P_4 - Stop bits: 0 or 1=1 stop bit, 2=2 stop bits

The +ISC command can also be used to initialize the smart card interface serial port. When +ISC is used, the wordsize, parity and stop bit settings are fixed at 8/None/1.

ISERIES - i-Series Printer Test

Models Supported P110i, P120i, P210i, P310i, P320i, P330i, P420i, P430i, P520i,

Description This command simply returns a <Ack> response when executed on an i-Series printer. Earlier printer models (such as the C series) will signal a error when this command is executed. The response to this command can be used to determine if the printer attached is an i-Series (or later) generation.

Syntax <Esc>ISERIES

Parameters None

J - Print Multiple Monochrome Cards

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   *NOTE: This command only applies to monochrome printing using a Monochrome Ribbon having a single continuos color and material; i.e., all black, all red, all green, etc.*

This command serves to print several monochrome cards from an image previously stored in the Resin Image Buffer.

NOTE: Error recovery is not possible from this command.

Syntax   `<Esc>J` p_1

Parameters p_1 = Number of cards to print

!L - Check Status: P720 Laminator Sensor Levels

Models Supported   P720c

Description   Allows a P720 Laminator Sensor Level Check

Syntax   <Esc># 1 !L{ p_1}

Parameters p_1 = Sensor

Where:
   None = All sensors
   0 = Ribbon Top (0~255)
   1 = Ribbon Bottom (0~255)
   2 = Temperature Top (0~255)
   3 = Temperature Bottom (0~255)
   4 = Decurling (0~255)
   5 = Entry (0~255)
   6 = X Top (0~255)
   7 = Y Top (0~255)
   8 = X Bottom (0~255)
   9 = Y Bottom (0~255)
   10 = Top Ribbon Detect (0~7)
   11 = Bottom Ribbon Detect (0~7)

!L - Check Status of Printer Sensors

Models Supported	P110i, P120i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description:	This command returns a series of numbers that are formatted as shown below: **TTT RRR PPP VV,V CCC hhh HHH LLL MMM**

The letters shown in the pattern above are actually numeric digits that correspond to 9 sensor status readings, as listed here:

TTT - Head temperature in arbitrary units.

RRR - Ribbon present sensor
> 000 = No ribbon installed
> 255 = Ribbon installed and detected

PPP - Card in print position sensor. This value will range from 000 - 255.A value below 032 indicates the absence of a card by the print head. A value over 224 indicates that a card is present.

VV,V - Main power supply voltage. Typical values range between 22,0 and 24,2 ("," equals decimal point)

CCC - Color ribbon sensor. Will be less than 032 when a yellow, magenta, or overlay/varnish panel is over the sensor.

hhh - Secondary print head position sensor. During normal operation, this sensor should always read 000. It will read 255 if the print head is out of position, neither fully up or fully down.

HHH - Primary print head position sensor. Reads 000 when the print head is 'up' and not ready to print. Will read 255 when print head is down and in contact with the ribbon and card surface.

LLL - Head State. Reads 000 when the print head is 'up' and not ready to print. Will read 255 when print head is down and in contact with the ribbon and card surface.

MMM - Magnetic encoder card position sensor.

> 000 = Card over sensor

> 255 = No card present in encoder

P330ᵢ Only: In addition to the values described above, the P330i model returns four additional values, all formatted as 3-fixed-digit decimal values separate by a single space. The additional values returned by the P330i are:

Card feed sensor level - A value under 32 indicates the presence of a card. A value over 192 indicates the absence of one.

Yellow ribbon color sensor level - Values below 100 (typically) indicate that a yellow or overlay ribbon panel is in print position.

Blue ribbon color sensor level - Values below 100 (typically) indicate that a cyan or overlay ribbon panel is in print position.

Smart card position sensor level - Values under 32 indicate the presence of a card in the smart card station position, whereas values over 192 indicate the absence of one.

Syntax: `<Esc>!L`

Parameters: None

$L - Draw a Horizontal Line/Rectangle in a Color Buffer

Models Supported	P110i, P120i, P210i, P310c, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Draws a line or rectangle in a color buffer. This command is the color imaging equivalent of the monochrome L/vL commands.
Syntax	<Esc>$L p_1 p_2 p_3 p_4 p_5 {p_6}
Parameters	p_1 = Horizontal (X-axis) dot start position
	p_2 = Vertical (Y-axis) dot start position
	p_3 = Horizontal (X-axis) width of graphic in dots
	p_4 = Vertical (Y-axis) height of graphic in dots
	p_5 = Color intensity level 0 - 31
	p_6 = Color buffer to operate on, as listed below:

> 0 - Yellow (default if not specified)
>
> 1 - Cyan
>
> 2 - Magenta
>
> 3 - Dye-sub black (Kdye)

&L - Read Single Track

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Reads data for a single track from a magnetic card.

Syntax `<Esc>&Ln`
`<Esc>&L n`

Parameters n = Track Number

Where:
   1 = Return Track 1 data as an ASCII string
   2 = Return Track 1 data as an ASCII string
   3 = Return Track 1 data as an ASCII string

   NOTE: Only p_1 values of 11, 12, and 13, require a preceding space.

   11= Return Track 1 data in ASCII hexadecimal format
   12= Return Track 1 data in ASCII hexadecimal format
   13= Return Track 1 data in ASCII hexadecimal format

The data returned will conform to the values shown in the table below.

Track	Characters (Default)	Field Separator	Length
1	\<Sp>$ ( ) - . / 0 through 9 A through Z (All Caps)	^	76
2	0 through 9	=	37
3	0 through 9	=	104
\<Sp>11	Hexadecimal*	N/A	*
\<Sp>12	Hexadecimal*	N/A	*
\<Sp>13	Hexadecimal*	N/A	*
* - See Appendix C.			

The actual data encoded onto the card is converted automatically from an ISO-track-specified encoding format to ASCII. See Appendix C for default ANSI/ISO data formats and custom data encoding commands.

If track data is returned in ASCII hex format, the value of each 2-digit hex number will have the same ordinal value that it would if the data read were returned in ASCII string format. For example, if the ASCII representation of the data read from the track is "01234", the hex version returned will be "3031323334".

+$L - Adjust Specified Color Intensity

Models Supported   P110i, P120i, P210i, P310c, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Sets the maximum color intensity (heat) level applied to a selected dye sublimation ribbon panel.

Syntax   `<Esc>+$L  p₁  p₂`

Parameters p_1 = Color Image buffer number:

Where:
 0 = Yellow (Y)
 1 = Magenta (M)
 2 = Cyan ©)
 3 = Dye Sublimation Black (K_{dye})

p_2 = Intensity

Where:
 5 = Printer default
 0~10 = p_2 range

!LC - Check Lamination Counter

Models Supported   P720c

Description   Checks the number of laminations since the last counter reset.

Syntax   `<Esc># 1 !LC`

Parameters   None

Description   Every time the printer laminates a card, the printer increments its lamination counter, and saves this value in non-volatile memory. The printer also maintains a count of the number of times it failed to laminate a card due to mechanical and print engine related problems.

This command allows the host to read the value of both of these counters. The values are reported in ASCII decimal, separate by a space, with the successful lamination counter value reported first.

Syntax   `<Esc>!LC`

Parameters   None

$LD - Initialize a Color Buffer to a Specified Intensity Level

Models Supported   P110i, P120i, P210i, P310c, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   The specified imaging buffer is initialized to a known state specified in the command. The buffer is "cleared" to a specified color intensity level.

Syntax   `<Esc>$LD` p_1 `{`p_2`}`

Parameters p_1 = Specifies the intensity level to initialize the specified color intensity level.

p_2 = The color buffer to initialize, as listed below:

0 - Yellow (default if not specified)

1 - Cyan

2 - Magenta

3 - Dye-sub black (Kdye)

!LT - Check Lamination Temperature

Models Supported	P720c
Description	Checks temperature of Lamination Rollers
Syntax	`<Esc># 1 !LT` p_1`{` p_2`}`
Parameters	p_1 = Roller Select

Where:
    0 = Top
    1 = Bottom

p_2 = If not 0, returns Default Value

+LT - Set Lamination Temperature

Models Supported   P720c

Description   Sets the temperatures for upper and lower lamination rollers

Syntax   `<Esc># 1 +LT p₁ p₂`

Parameters p_1 = Roller select

Where:
   0 = Upper
   1 = Lower

p_2 = Temperature

Do not set lamination temperature above 200^0F.

!LTI - Check Lamination Time

Models Supported   P720c

Description   Returns setting for time spent passing through the
Lamination Rollers

Syntax   `<Esc># 1 !LTI p₁`

Parameters p_1 = If other than 0, returns Default Value

+LTI - Set Lamination Time

Models Supported   P720c

Description   Sets time it takes for cards to pass between the lamination rollers

Syntax   `<Esc># 1 +LTI p`$_1$

Parameters p_1 = Time in tenths of seconds (Default of 100 specifies 10 seconds)

L/vL - Draw Horizontal Line (Monochrome/Overlay)

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Downloads a Monochrome Graphic line using parameters to specify origin, height, and width. The resulting line overwrites any existing graphics data. The "L" command writes to the buffer used for Resin Printing. The "vL" command writes to a buffer used for Varnish Printing.

Syntax   <Esc>L p_1 p_2 p_3 p_4 p_5

Parameters p_1 = Horizontal (X-axis) Start Position (X) in dots

p_2 = Vertical (Y-axis) Start Position (Y) in dots

p_3 = Horizontal (X-axis) Width of graphic in dots (i.e. horizontal lines)

p_4 = Vertical (Y-axis) Height of graphic in dots

p_5 = Graphic Mode

Where:
- 0 = Clear Print Area and load Reverse Bit Map Image
- 1 = Clear Print Area and load Standard Bit Map Image
- 2 = Overwrite Background Bit Map Image in Printable Dot Locations, leaving Non-Printing Dot Locations alone

Figure 2-5
Line /Rectangle
Image Positioning

Line Image Origin
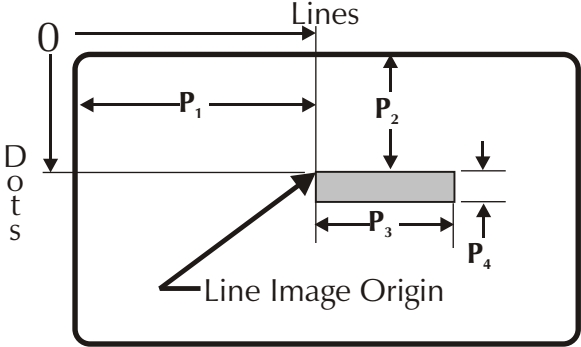
!M - Move Print Head Up

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Moves the Print Head Assembly up from the card (and platen roller)
Syntax	`<Esc>!M`
Parameters	None

For the P520i laminator heat roller, the # 1 !M command will move the laminator head up.

MB - Return Card To Card Feeder

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Moves the card in the reverse direction and returns the card to the card feed point (just inside the card printer) from any position between the card feeder and the output hopper.

When sent to P520 laminator:

Returns a card in laminator to card flip station.

Syntax <Esc>MB

Parameters None

MC - Clear Media Path

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Sends any card in the media path of the printer to the output hopper

NOTE: A ribbon error can leave a card in the printer. if issued at power-on, this command assures a clear media path for subsequent operations.

Syntax `<Esc>MC`

Parameters None

MCL - Move Contactless

Models Supported	P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	P310 and P420 printers offer a means to step proximity cards (also called contactless cards) forward or backward relative to the card sensor.
Syntax	`<Esc>MCL` p_1 p_2
Parameters	p_1 = Steps Moved
	p_2 = Direction

	Where:
	    0 = Forward
	    1 = Backward

Example	`<Esc>MCL 200 1`
	This example places a card 1800 steps past the card sensor. (i.e., +OCL command default (2000) minus MCL command p_1 (200) = 1800)

ME - Exit Card To Output Hopper

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Moves and exits a single card from any position to the output hopper.

When sent to a P520 laminator, sends a card in the laminator to the output hopper.

Syntax   `<Esc>ME{ `p_1`}`

Parameters p_1 = Number of cards to pass through printer (p_1 omitted specifies a single card)

MF - Flip Card

Models Supported   P120i, P420c, P430i, P520c

Description   Flips a card to opposite side for Duplex Printing

NOTE: For user safety, a card flip requires a closed cover.

For P420:

Card remains in the Card-Flip Assembly.

For P520:

If a card is in the printer, places card in Card-Flip, flips card, and returns card to Print-Ready position.

If no card is in the printer, feeds a card prior to placing a card in Card Flip, flipping card, and returning card to Print-Ready position.

Syntax   `<Esc>MF`

Parameters   None

Example   See +DLAMI Command

All G/Z, GS buffering commands following the MF will load data in the secondary YMCKO data buffers.

MI - Move Card Into Print Ready Position

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Moves a card from the card input hopper to the print ready position

Syntax   <Esc>MI{ p_1}

Parameters p_1 = None (Move card into print ready position)

p_1 = 1 (Moves card to laminator station—P520 and P720 only)

MIB - Move Card Back To Print Ready Position

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   For P310/P320/P420:

Moves a card from beyond the print position back to the print ready position

For P520:

Sent to printer, returns a card from beyond the print ready position of printer (not yet in laminator) to the print ready position of printer

Sent to laminator, returns a card to laminate ready position

Syntax   `<Esc>MIB`

Parameters   None

MM - Move Card Through Printer

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description For All Models:

Allows a card to be moved an arbitrary distance either forward or backward through the print mechanism.

Syntax `<Esc>MM P₁ {P₂}`

Parameters P_1 - Distance to move card through mechanism, measured in dot-line units. A distance of 300 will move the card 1 inch (225.4 mm).

P_2 - Optional. If not specified, or 0, the card is moved forward through the mechanism, towards the card exit. If this value is specified and   1, the card is moved backward, toward the card entrance. On the P205 and P210i, a 0 will move the card backward, toward the card entrance, while a 1 will move the card forward, toward the card exit.

This command is provided primarily for testing the integrity of the card transport mechanism. Unusual print errors or odd results might be seen on the next card printed following the use of this command.

M/m - Multiple Command

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Groups and repeats a string of commands a specified number of times. "M" differs from "m" only regarding the response to errors. Errors encountered during commands linked by "m" commands abort any remaining commands, while M-linked commands resume after an appropriate error response.

Syntax `<Esc>M` p_1 `c`$_1$`[c`$_2$`[c`$_3$`...[c`$_n$

Parameters p_1 = Number of times to repeat following command string

$c_1 \sim c_n =$
        Series of linked commands that will be repeated p_1 times. Note the square bracket ([) delimiters.

Example This example shows an "M" command used to group and repeat four commands.

`<Esc>M 3 MI[!D[!M[MO`

The "M" command groups a command string. A card loads to the print-ready position with the "MI" command. "!D" lowers the print head; "!M" raises the print head, and "MO" sends the card to the output hopper.

The "M" command specifies three repeats of this sequence. If an error occurs (e.g., the input hopper runs out of cards) a command sequence linked by the "M" command terminates. In contrast, after error correction and an associated pressing of the panel button, a command sequence linked by the "m" command resumes.

MO - Move Card To Output Hopper

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i,
P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   For P310, P320, and P420:

Moves and exits a single card from any position except
the input hopper to the output hopper.

For P520:

Sent to printer, ejects a card from anywhere in printer
except the input hopper to the output hopper.

Sent to laminator, ejects a card in laminator to the output
hopper. If no card is present, printer responds ACK.

For P720:

Moves card from the printer station to the laminator
station.

Syntax   `<Esc>MO`

Parameters   None

MR - Check for Card Presence

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Returns status to host indicating whether or not a card is present within the print mechanism.

Syntax   `<Esc>MR {P₁}`

Parameters   Detection/status option, where:
0/omitted: Check for card in the primary print path only and report "Card Present" or "Feeder Error" status.

1: Same as 0, but returns an "OK" response if a card is present.

10: The card flip mechanism, if present, is checked for a card in addition to the primary path. A "Card Present" status code is returned if a card is detected, otherwise, a "Feeder Error" status is returned.

11: Same as 10, but returns an "OK" response if a card is present.

MRB - Move Card to Reject Box

Models Supported   P420c, P420i, P430i, P520c, P520i, P720c

Description   P420c, P420i, P430i, P520c, P520i, and P720c printers have a hopper used to collect rejected cards. This command places the card being processed into this box.

Syntax   `<Esc>MRB`

Parameters   None

MS - Move Card To Smart Card Programmer

Models Supported   P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Moves a card to the smart card docking station and engages the smart card programming contacts. The card remains in smart card docking station until a card movement command is sent.

NOTE: Pins 5 and 9 of the DB-9 connector briefly interconnect to signal an external programming device that the card is ready to program.

Syntax   `<Esc>MS`

Parameters   None

MS - Move Card To Smart Card Programmer

Models Supported   P330i, P430i

Description   Moves a card to the smart card docking station and engages the smart card programming contacts. The card remains in smart card docking station until a card movement command is sent.

Syntax   `<Esc>MS p1`

Parameters   p1: Type of movement, where:

> none =   Load contact smart card into contact station, engage the solenoid and initialize the contact reader communication environment.
>
> 1 =   Engage the contact station's solenoid.
>
> 2 =   Disengage the contact station's solenoid.
>
> 3 =   Load a card from feeder into contact-less HID reader antenna area, also initialize the HID reader communication environment.
>
> 4 =   Load a card from feeder into contact-less MiFare reader antenna area, also initialize the MiFare reader communication environment.

&– Select Magnetic Encoding Standard

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Selects the magnetic encoding standard to use (ISO or JIS).
Syntax	`<Esc>&N P`$_1$
Parameters	p1 - Encoding standard, where:

$0 = $ JIS(II)

$1 = $ ISO

JIS encoding, if selected, can only be done on track 1. Tracks 2 and 3 will always be written in ISO (or custom) format, regardless of the value set by this command.

!NL - Get Printer Impression and Error Counters

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Every time the printer makes a single printing pass over a card, the printer increments its impression counter, and saves this value in non-volatile memory. The printer also maintains a count of the number of times it failed to print a card due to mechanical and print engine related problems.

This command allows the host to read the value of both of these counters. The values are reported in ASCII decimal, seperated by a space, with the print impression counter value reported first.

The impression counter does not necessarily reflect the total number of CARDS printed. For example, a full-color single-sided card printed using a YMCKO ribbon will require up to 5 print impressions - one for each ribbon panel Y, M, C, K and O - to generate a single printed card. The !CC command (described elsewhere in this document) can be used to get the actual number of cards printed.

Syntax   `<Esc>!NL`

Parameters   None

!O - Check Card Offset

Models Supported   P430i, P720c

Description   Checks Offset from Laminator Card Sense to Laminator Rollers

Syntax   `<Esc># 1 !O{ `p_1` }`

p_1 = Offset (Query)

Where:
    If p_1 is not 0, Printer returns default value.

+O - Print Offset X-Axis

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Alters the horizontal (X-axis) start print offset point, in dots
Syntax	<Esc>+O p_1
Parameters	p_1 = Horizontal (X-axis) start print offset, in dots:

Where:
    8 = Default
    0~20 = Range

+OCL - Offset Contactless

Models Supported	P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i
Description	The P310c, P310f, P310i, P320i, P330i, P420c, P420i, and P430i printers offer a means to program proximity cards (also called contactless cards). This command includes a parameter that specifies the steps from the card sensor to a card position suitable for proximity card programming.
Syntax	`<Esc>+OCL p`$_1$
Parameters	p_1 = Steps past card sensor (Defaults to 2000)

!OFP - Check X-Axis Patch Offset

Models Supported	P720c
Description	Checks X-Axis Offset setup for upper or lower laminator patch applications
	NOTE: See +OFP Command to change offset(s).
Syntax	`<Esc># 1 !OFP` p_1
Parameters	p_1 = Laminator patch selection

	Where:
	    0 = upper
	    1 = lower

+OFP - Adjust X-Axis Laminator Patch Offset

Models Supported   P720c

Description   Establishes X-Axis patch positioning setup

NOTE: See !OFP command for check of current offset.

Syntax   `<Esc># 1 +OFP` p_1 p_2

Parameters p_1 = Patch selection

Where:
    0 = upper
    1 = lower

p_2 = Offset

Where:
    Range = 100~800

+OLP - Offset Overlaminate Patch

Models Supported   P520c, P520i

Description   Specifies the relationship between card positions and ribbon sync markers used to place lamination patches on cards

Note that except for the first patch, the firmware can use ribbon sync marker sensing in concert with flag sensor increment sensing to determine ribbon advance step requirements for patch applications. however, a ribbon initialization leaves the firmware without an associated history for ribbon step requirements. Because of this, the firmware needs a beginning step value for use only to position the ribbon after an Initialization.

NOTE: This command only applies to P520 laminator stations and ribbons with Sync. Markers.

Syntax   `<Esc># 1 +OLP` p_1 p_2 p_3

Parameters p_1 = Card offset count from ribbon sync. marker sense to the point p_2 takes effect. Only used to synchronize lamination patches that follow Initializations

p_2 = Offset between where patch applications start

p_3 = Count where patch applications end

Default Settings   `<Esc># 1 +OLP 110 140 90`

!OP - Check Patch Offsets

Models Supported	P720c
Description	Returns laminator patch offset values
Syntax	`<Esc># 1 !OP p₁ p₂{ p₃}`
Parameters	p_1 = Laminator patch selection

Where:
    0 = Top
    1 = Bottom

P_2 = Axis Selection

Where
    0 = X Axis
    1 = Y Axis

p_3 = If different than 0, returns default value

+OP - Adjust Laminator Patch X and Y Offset

Models Supported   P720c

Description   Allows centering of patch applications

Syntax   `<Esc># 1 +OP` p_1 p_2 p_3

Parameters p_1 = Patch selection

Where:
    0 = Top
    1 = Bottom

p_2 = Card Axis selection

Where:
    0 = X Axis
    1 = Y Axis

p_3 = Offset (0~10 millimeters)

+OS - Smart Card X-axis Offset

Models Supported	P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Offsets the horizontal (X-axis) smart card programmer location in dots
Syntax	<Esc>+OS p_1
Parameters	p_1 = Horizontal start position (X) in dots

Where:
112 = Default*
0~192 = Range*

* For 330*i* only: Default = 1 and Range = None

O/vO - Load Single Line Bit-map (Monochrome)

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Downloads a single line of monochrome bit-map data into a monochrome image buffer. The printer uses a proceeding "G" command to specify and control the line bit-map placement. An "O" command specifies the monochrome buffer used for resin printing, and a "vO" command specifies a monochrome buffer used for varnish printing.

Syntax `<Esc>Odata{ CHECKSUM}`
`<Esc>vOdata{ CHECKSUM}`

NOTE: No space (20 Hex.) exists between the "O" and the "data."

Parameters data =
> Uncompressed or compressed monochrome bit-map data. Data length must match the line length specified in the proceeding "G" command.
>
> See Chapter 1 for the relationship of monochrome bit-maps to data.

CHECKSUM =
> Single byte of XOR data generated from image data. If CHECKSUM is specified by the related G/vG command, a checksum must be included here.

Example Preceding command is:

`<Esc>G 200 200 0 2 15 1`

(This "G" command specifies 15 lines of 2-byte bit-map data)

The 15 "O" command lines immediately follow the "G" command as:

> `<esc>Odata` Line1
> `<esc>Odata` Line2
> `<esc>Odata` Line3
>   etc.

O/vO - Load Single Line Bit-map (Continued)

Figure 2-6
Line by Line Image
Object &
Hexadecimal Code
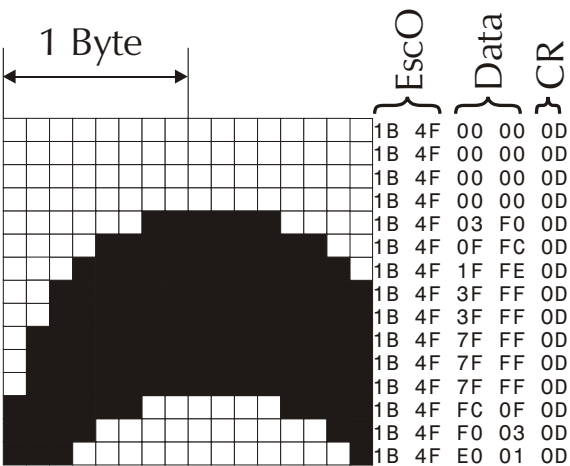
1 Byte

EscO Data CR

```
1B  4F  00  00  0D
1B  4F  00  00  0D
1B  4F  00  00  0D
1B  4F  00  00  0D
1B  4F  03  F0  0D
1B  4F  0F  FC  0D
1B  4F  1F  FE  0D
1B  4F  3F  FF  0D
1B  4F  3F  FF  0D
1B  4F  7F  FF  0D
1B  4F  7F  FF  0D
1B  4F  7F  FF  0D
1B  4F  FC  0F  0D
1B  4F  F0  03  0D
1B  4F  E0  01  0D
```

Any chance control characters that appear among the data require a preceding open bracket ([) character. Control characters include escape (1B hex), enter (0D hex), and the open bracket (5B hex). The command lines would appear as:

Figure 2-7
Line by Line Image
Object &
Hexadecimal Code
with control
characters

1 Byte

EscO Data CR

```
1B  4F  5B  1B  00      0D
1B  4F  00  5B  0D      0D
1B  4F  5B  1B  5B  0D  0D
1B  4F  5B  5B  6A      0D
1B  4F  C5  5B  1B      0D
```
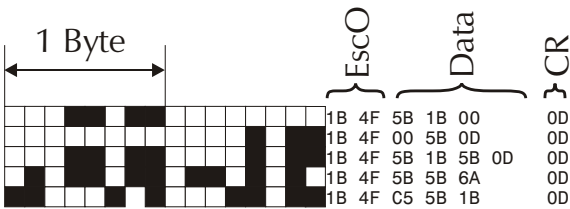
+OY - Print Offset Y-axis

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Offsets the vertical (Y-axis) start print location in dots

Syntax   <Esc>+OY p_1

Parameters p_1 = Vertical (Y-axis) offset, in dots

Where:
    18 = Default

!P - Move Card Forward 8 cm

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   If a card is present in the printer mechanism, it is moved forward 8 cm. The card transport motor is activated even if a card is not present within the mechanism. This command is typically used to test the operation of the card transport mechanism..

Syntax   `<Esc>!P`

Parameters   None

&P - Check Card Present - Encoder

	The card printer responds to commands (with data or error codes) via the Bi-directional Serial Interface only. Printers with parallel interfaces cannot respond to this command, (other than flagging an error). In a Test Environment, card printers can operate with both interfaces attached and communicating with the printer. The Printer CPU Board has associated connectors.

Models Supported P310c, P310f, P310i, P320i

Description This command is used to check for the presence of a card in the Magnetic Encoder Station.

Syntax `<Esc>&P`

Parameters None

Response Typical status responses:

(NACK)05(EOT) - Card in Magnetic Encoder

(NACK)06(EOT) - Card not in Magnetic Encoder

+PRF - Pre-Feed a Card Close to the Print Area

Models Supported   P330i, P430i

Description   Pre-feeds a card to the printing area or Smart Card sensor area before the next print. A card is pre-fed to the print area after the previous card was ejected. With an internal contact smart card installed printer, a card is pre-fed to the Smart Card sensor location instead of the printing position.

Syntax   `<Esc>+PRF p1`

Parameters   p1: Enable / Disable Pre-Feed, where

  0 = Disable Pre-Feed

  1 = Enable Pre-Feed

PS - Download Color Image Buffer

Models Supported	P110i, P120i, P210i, P310c, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Initializes and downloads Separated Color Data ©, M, Y, or K) for an associated complete Single-Color Image Buffer.
Syntax	`<Esc>PS p`$_1$` p`$_2$` `*`data`*
Parameters	p_1 = Color image buffer number

Where:
> 0 = Yellow (Y)
> 1 = Magenta (M)
> 2 = Cyan ©)
> 3 = Dye Sublimation Black (K_{dye})

p_2 = Data Mode:

Where:
> 32 = Uncompressed Data - 256 levels
> (00~FF Hex.)
> 30 = Compressed Data - 32 levels (00~1F Hex.)

data =
> Uncompressed or compressed Color Bit-Map Data for a single separated color.

Where the Color Buffer Maximum is:
> 655,360 Compressed Bytes

P/vP - Draw Single Dot (Monochrome/Overlay)

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Writes a single monochrome dot to a monochrome image buffer. The " P"command writes to the buffer used for Resin printing. The vP command writes to a buffer used for varnish printing.

Syntax   <Esc>P p_1 p_2 p_3
vP p_1 p_2 p_3

Parameters p_1 = Horizontal (X-axis) start position (X) in dots

p_2 = Vertical (Y-axis) start position (Y) in dots

p_3 = Graphic mode:

Where:
  0 = Clear print area and load reverse bit map image

  1 = Clear print area and load standard bit map image

  2 = Overwrite previous bit map image in prescribed dot locations, without clearing non-printing locations

R - Reset

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Reinitializes printer
	NOTE: P520 laminators can be reset by using the <Esc># 1 R command direction sequence.
Syntax	`<Esc>R`
Syntax (P520 Laminator)	`<Esc># 1 R`
Parameters	None

!R - Print Head Resistance

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Enters Manufacture's Average Resistance that appears on the Print Head Label. Note that replacements to Print Heads with 10-micron glass can produce faint printing if not offset (typically with increases of between 180 and 225 ohms). An offset that optimizes print quality should be found.

NOTE: This setting interacts with the following commands:

+C	Thermal Transfer Intensity
+$L	Color Intensity
+$C	Color Contrast

Syntax   `<Esc>!R p`$_1$

Parameters p_1 = Resistance

Where:
   For P310, P320, P420, P520, P720:
   $p_1 = 1400\sim2350$

   For P205, P210:
   $P_1 = 1400\sim5000$

Example   In the following example, 1567 ohms is entered, based on the resistance value marked on the print head label.

`<Esc>!R 1567`

&R - Reset Magnetic Encoder

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Clears Magnetic Encoder Command and Data Buffers

This command does not return the track data format or density to default values. This command should be sent when reformatting the encoder parameters. Do not send this command for every card.

Syntax   `<Esc>&R`

Parameters   None

>R - Read Data From Smart Card Serial Interface

Models Supported   P330i, P430i

Description   This command will read data from the smart card serial interface and pass it back to the host, unchanged, until the internal serial port receive buffer is emptied. The printer logic constantly monitors and buffers data received by the smart card serial port (even when the >R command is not executing) so there is little danger that receive data will be lost unless the internal serial receive buffer overflows.

To receive a complete data stream from the smart card serial port, simply continue to issue >R commands, adding whatever data is sent back to the host into a buffer until the expected end-of-data token or packet block is received.

The communication mode (contact vs. contactless) used is dependent on the mode set by the last >W or >WB command that was issued.

The printer logic does not modify the data from the serial port that is passed back to the host in any way, but the printer logic will add the usual (OK) acknowledge code at the end of the data stream for each invocation of the >R command.

Syntax   <Esc>>R

Parameters   None

Communication mode (contact vs. contactless) depends on the mode specified in the last >W or >WB command issued.

+RB - Set Reject Box Usage

Models Supported	P420c, P420i, P430i, P520c, P520i, P720c
Description	In P420s, P520s, and P720s, this command determines the hopper used to collect cards rejected because of printing or encoding errors. Unless changed, the printer sends encoding rejects to the reject hopper and printing rejects to the output hopper.
Syntax	`<Esc>+RB` p_1 p_2
Parameters	p_1 = Error Type

Where:
  0 = Encoding & printing
  1 = Encoding only
  2 = Printing only

p_2 = Hopper used

Where:
  0 = Exit hopper
  1 = Reject hopper

Examples:	+RB 1 1
	+RB 2 0

>RB - Read Data From Smart Card Serial Interface in ASCII hex Form

Models Supported   P330i, P430i

Description   Like the >R command, this command will read data from the smart card serial port receive buffer and pass it back to the host until the contents of the receive buffer have been emptied. Unlike the >R command, which sends data to the host in raw binary form, the >RB command formats the data as a stream of 2-digit ASCII hexadecimal values. Each byte received is represented by exactly 2 digits (with leading zero if needed). There is NO intervening space placed between values sent. Alphabetic digits (A through F) are sent in lowercase. The example below shows how the data sent to the host would be formatted:

05413fb50d

Note the presence of leading 0's for some values (05 and 0d), the use of lowercase values for alpha digits, and the lack of spaces between each 2-digit pair.

The communication mode (contact vs. contactless) used is dependent on the mode set by the last >W or >WB command that was issued.

Syntax   <Esc>>RB

Parameters   None

Communication mode (contact vs. contactless) depends on the mode specified in the last >W or >WB command issued.

RCBC - Reset Rejected Card Box Counter

Models Supported   P420c, P420i, P430i, P520c, P520i, P720c

Description   In P420s, P520s and P720s this command resets the counter that keeps track of the number of cards placed in the Rejected Card Box.

Syntax   <Esc>RCBC

Parameters   None

>RG - Contact Internal Gemplus Smart Card Read Command

Models Supported	P330i, P430i
Description	Read data from the Gemplus internal smart card reader. The >RG command formats the received data (from the reader) as a stream of 2-digit ASCII hexadecimal values. Each byte received is represented by exactly 2 digits (with a leading zero if needed. There is NO intervening space placed between values sent. Alphabetic digits (a through f) are sent in lower case.
Syntax	<Esc>>RG
Parameters	None

+RIB - Set Ribbon Type

Models Supported   P310c, P420c, P520c, P720c

Description   For non RFID printers, sets printer operation for either a standard or one of the nonstandard ribbons, as follows:

- standard ribbons:
  k_{resin} (Monochrome—except P310)
  $YMCK_{resin}O$
  $K_{dye}O$
  $K_{resin}O$

- Nonstandard ribbons:
  $YMCK_{resin}OK_{resin}$
  YMC
  $YMCK_{resin}$
  $YMCK_{resin}\_K_{resin}$

NOTE: All models synchronize ribbons automatically after an unlatch and latch of the print head, but require a p_1 setting of 4 to avoid attempted ribbon synchronization with monochrome ribbons installed. Without this setting, some ribbon waste occurs in an attempted synchronization.

Syntax   `<Esc>+RIB p`$_1$

Parameters p_1 = Ribbon type

Where:
  0 = Standard ribbon
  4 = Monochrome ribbon
  10 = 6-Panel ribbon ($YMCK_{resin}OK_{resin}$)
  11 = 3-Panel ribbon (YMC)
  13 = 4-Panel ribbon ($YMCK_{resin}$)
  21 = 5-Panel ribbon w/two K_{resin} ($YMCK_{resin}\_K_{resin}$)

Note: Card imaging using the YMCKOK ribbon requires the following command sequence:

IS 0	Image Yellow
IS 1	Image Magenta
IS 2	Image Cyan
I	Image Black & Return (YMCKOK only)
IV 10	Image Varnish and Return
I 20	Image Black and Return
MO	Eject Card

!RIBBON - Check Ribbon Type

Models Supported   P720c

Description   Returns information for the type of lamination ribbon installed

Syntax   `<Esc># 1 !RIBBON p`$_1${ `p`$_2$}

Parameters p_1 = Ribbon Selection

Where:
    0 = Upper
    1 = Lower

p_2 = Ribbon Information (Optional)

Where:
    None = Current ribbon type setting
    0 = Default Temperature for Ribbon Type
    1 = Temperature Setting for installed
    2 = X Offset Setting for installed
    3 = Y Offset Setting for installed
    4 = Cassette available (Upper or Lower)
    5 = Color Signature for installed
    6 = Part Number for installed

!RIBBON - Get ribbon type installed

Models Supported:	P210i, P310i, P320i, P330i, P420c, P430i, P520i
Description:	Returns a number representing the type of ribbon installed based on the table below:

ID	Ribbon type
0	No ribbon installed
1	Unknown (monochrome)
2	YMCKO 200
3	YMCK 250
4	YMCKK 200
5	YMCKOK 170
6	YMC 300
7	Monochrome
8	Monochrome
9	Monochrome
10	Monochrome
11	Monochrome
12	Monochrome
13	Monochrome
14	YMCKO 330
15	YMCK 400
16	KdO 500
17	KrO 500
18	Scratch-off Gray 800
19	Secure Hologram 350
20	PCard Hologram 350
21	Clear 350
22	YMCKU
23	YMCUK
24	YMCUK
25	YMCKU
26	YMCUK
27	YMCUK
28	YMCKUK
29	Halfpanel YMC
30	Halfpanel YMC/Full KO
31	UV Overlay 1000

Ribbon type abbreviations:	YMC :	Yellow/Magenta/Cyan (color capable)
	K/Kr :	Black resin
	Kd :	Black dye
	O :	Clear overlay
	U :	Ultraviolet-protection overlay

Syntax:	!RIBBON
Parameters:	None

+RIBBON - Set Ribbon Type

Models Supported   P720c

Description   Specifies a lamination ribbon

Syntax   `<Esc># 1 +RIBBON `p_1` `p_2

Parameters p_1 = Ribbon selection

Where:
    0 = Top
    1 = Bottom

p_2 = Ribbon type

Where:
    0 = No Ribbon
    1 = Unknown Ribbon
    2 = Single Side Lamination Top
    3 = Single Side Lamination Bottom
    4 = 800015-714
    5 = 800015- 712
    6 = 800015-713
    7 = 800015-715
    8 = 800015-716
    9 = 800015-717
    10 = 800015-718
    19 = 800015-031

!RIBPN- Get ribbon part number

Models Supported:	P210i, P310i, P320i, P330i, P420i, P430i
Description:	Returns the Zebra part/order number associated with the ribbon currently installed in the printer.
	Example: If a YMCKO-330 ribbon is presently installed issuing the !RIBPN command will return the value **800015-540**
Syntax:	!RIBPN
Parameters:	None

Part numbers for printer supplies (including ribbons) are subject to change. Consult the most recent Card Printer Supplies List to ensure the part numbers for ribbons to be ordered is correct.

!RIBLEN- Get number of remaining panels on ribbon

Models Supported:	P110i, P120i, P210i, P310i, P320i, P330i, P420i, P430i, P520i
Description:	Returns an estimate of the number of unused panel sets remaining on the ribbon presently installed. This value indicates how many cards can be printed with the present ribbon before it will need to be replaced.
Syntax:	!RIBLEN
Parameters:	None

+RO - X-Axis Offset, Relative

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Offsets X-axis print origin plus or minus dot values from current setting

NOTE: For entry of exact X-Axis offsets, see the +O command.

Syntax `<Esc>+RO p`$_1${ `p`$_2$}

Parameters p_1 = Direction

Where:
0 = increase
1 = decrease

p_2 = Offset (default = 1)

+ROY - Y-Axis Offet, Relative

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Offsets Y-axis print origin plus or minus dot values from current setting

NOTE: For entry of exact Y-Axis offsets, see the +OY command.

Syntax <Esc>+ROY $p_1\{$ $p_2\}$

Parameters p_1 = Direction

Where:
   0 = increase
   1 = decrease

p_2 = Offset (default = 1)

!SA - Self Adjust

Models Supported   P110i, P120i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Initiates a printer self-adjust sequence or a returns potentiometer values

NOTE: Except for P205 and P210 printers, this command requires the prior installation of a 5-panel YMCKO ribbon and works best with 10-mil cards. P205 and P210 printers Self Adjust without a ribbon installed. Successful completion results in adjustment of all sensors and voltages, confirmed by no errors indicated.

Syntax   `<Esc>!SA{ p`$_1$`}`

The **!SAN** command should be executed before using the **!SA** to force a new adjustment sequence. Refer to the description of the **!SAN** command for further information.

Parameters   p1 - Read/write mode

Where:

0/None = Perform adjustment sequence

1 = Return calibration values

Calibration values are returned to the host as a sequence of ASCII decimal numerics separate by spaces. A minimum of 8, and a maximum of 12 values will be returned, depending on the printer configuration.

For the P330i, the values returned are:

    1. Card position sensor active threshold in mV

    2. Card position emitter power setting (0-255)

    3. Ribbon color sensor #1 emitter power setting (0-255)

    4. Ribbon color sensor #2 emitter power setting (0-255)

    5. Desired ribbon take-up spool motor voltage (while printing) in 0.1V units (e.g. 185 = 18.5V)

    6. Ribbon motor power setting for printing (0-255) (lower values indicate a higher voltage/power setting)

    7. Indeterminate value; not used

    8. Card feed sensor emitter power level (0-255)

If the mag encoder option is installed:

9. Mag encoder saturation threshold in mV

10. Mag encoder power setting (0-255)

If the external smart-card encoding option is installed:

11. Smart card station card position sensor active threshold in mV

12. Smart card station card position emitter power setting (0-255)

For all other printers, the values returned are:

1. Card position sensor active threshold in mV

2. Card position emitter power setting (0-255)

3. Ribbon color sensor active threshold in mV

4. Ribbon color sensor power setting (0-255)

5. Desired ribbon take-up spool motor voltage (while printing) in 0.1V units (e.g. 185 = 18.5V)

6. Ribbon motor power setting for printing (0-255) (lower values indicate a higher voltage/power setting)

If the mag encoder option is installed:

7. Mag encoder saturation threshold in mV

8. Mag encoder power setting (0-255)

!SAN - Perform pre-calibration baseline testing

Models Supported P110i, P120i, P330i, P430i

Description This command performs a number of baseline sensor measurements that are used by the !SA automatic calibration command. To ensure proper printer calibration, this command should always be executed prior to executing !SA.

The ribbon panel-color sensors located near the printhead are one of the sensors for which baseline measurements are taken. Accurate measurement of baseline response requires that the ribbon be removed. The printer will signal an error if a ribbon is installed when this command is executed.

Syntax <Esc>!SAN

Parameters (NONE

The **!SAN** command should be executed prior to using the **!SA** automatic calibration command.

!SB - Check Stand-By Mode Settings

Models Supported	P720c
Description	Returns delay and temperature values established by the +SB Command
Syntax	`<Esc># 1 !SB`
Parameters	None

+SB - Configure Laminator Stand-By Mode

Models Supported   P720c

Description   Establishes timing laminator entry into stand-by mode, and sets roller temperature to maintain in stand-by mode.

Syntax   `<Esc># 1 +SB` p_1 p_2

Parameters p_1 = Idle period (seconds) before laminator enters stand-by mode.

p_2 = Laminator roller temperatures (°C) during stand-by mode

Default   `<Esc># 1 +SB 1800 100`

SDATA - Force immediate save of parameters

Models Supported P330i, P430i

Description Many of the printer parameters that can be set using the various commands described in this reference are backed up to the printers non-volatile memory on a periodic basis; usually once every 10 minutes. However, if parameters are changed and the printer is powered down before the auto-save cycle has started, the new values will not be saved, and the printer will power up using the older settings.

The SDATA command can be used after modifying one or more parameters to force a save operation. This command is best used following a sequence of parameter setting commands, so all the changes can be saved in one write operation. The FLASH memory used by the printer to save its settings can only tolerate a finite number of write cycles, so the number of write cycles that are initiated by SDATA should be restricted to the minimum necessary.

Syntax `<Esc>SDATA`

Parameters None

!SERIE - Get Laminator Serial Number

Models Supported   P720c

Description   Returns serial number of P720 laminator

Syntax   `<Esc># 1 !SERIE`

Parameters   None

%SERIE - Get Printer Serial Number

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Every printer manufactured by Zebra Technologies is assigned a unique serial number after passing post-manufacturing quality and functional tests. This command can be used to retrieve the serial number that has been assigned to the printer unit as a whole.
Syntax	`<Esc>%SERIE`
Parameters	None

SF - Synchronize Film (Overlaminate)

Models Supported   P520c, P520i

Description   Positions P520 Overlaminate Lamination Ribbon with its black index mark at sensor. This is a first-time ribbon synchronization used to position a die-cut panel a known offset from the Laminator Station of P520 card printers. The command is only required for an initialization just after installing an Overlaminate Ribbon. Subsequent applications of die-cut Overlaminate panels occur via offsets from the previous panel application.

NOTE: A Laminator previously set for the application of Varnish (see TF Command) does not respond to this command.

P520 Syntax   `<Esc># 1 SF`

Parameters   None

!SIDE - Check Lamination Mode

Models Supported	P720c
Description	Returns current setting for card side(s) laminated
Syntax	`<Esc># 1 !SIDE`
Parameters	None
Responses	0 = Single side top
	1 = Double side
	2 = Single side bottom

+SIDE - Set Lamination Mode

Models Supported   P720c

Description   Chooses between double- and single-side lamination

Syntax   `<Esc># 1 +SIDE p`$_1${ `p`$_2$`}`

Parameters p_1 = Mode

Where:
0 = Single side
1 = Double side

p_2 = Laminated side (Only needed for p_1 = 0)

Where:
0 = Single side laminated faces up
1 = Single side laminated faces down
None =
Same as 0's for both parameters

&SVM - Disable/Enable Magnetic Encoding Verifications

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Disables or enables read-after-write checking of magnetic stripe encodes
Syntax	<Esc>&SVM p_1
Parameters	p_1 = Disable/Enable

Where:
0 = Disable
1 = Enable (Default)

&T - Magnetic Encoder Card Eject

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Sends any single card in the Card Path positioned between the Card Feeder and the Output Hopper to the Output Hopper
Syntax	`<Esc>&T`
Parameters	None

+TC - Set Laminator Head Temperature

Models Supported	P520c, P520i
Description	For P520s, sets amount of heat applied in transferring material or die-cut panels from the laminator ribbon to the cards.
P520 Syntax	`<Esc># 1 +TC` p_1
Parameters	p_1 = Temperature (degrees C)

Where:
  165   P520 overlaminate
  155   P520 varnish

NOTE: Maximum settable temperature is 220° C.

TF - Film Type

Models Supported P520c, P520i

Description Specifies either Overlaminate or Varnish as the type of Ribbon installed in the Laminator Station of P520s

Syntax `<Esc># 1 TF p`$_1$

Parameters p_1 = Type of Laminator Ribbon

Where:
   0 = Varnish
   1 = 1-mil Clear Overlaminate
   10 = Hologram Varnish
   12 = 0.6-mil Hologram Patch
   13 = 1-mil Hologram Patch
   19 = Full Alternated with Mag. Patches

T/vT - Draw Text (Monochrome/Overlay)

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Downloads a single line of modified ANSI Windows characters as text. See Appendix A for Character Map. The "T" command downloads to the Resin Buffer, and the "vT" command downloads to the Varnish Buffer.

A printer error occurs when text extends beyond the addressable buffer area. The resident fonts derive from proportionally-spaced 100-point Bold and 100-point Normal. Font kerning minimizes characters spacing.

Syntax $<Esc>T$ p_1 p_2 p_3 p_4 p_5 p_6 p_7 *data*
           vT p_1 p_2 p_3 p_4 p_5 p_6 p_7 *data*

Parameters p_1 = Horizontal (X) Start Position in dots

p_2 = Vertical (Y) Start Position in dots (position of lower case descender, if used)

p_3 = Rotation & Origin

Where:

Value	Description	Origin
0	No rotation	Lower Left
1	90 degrees	Lower Left
2	180 degrees	Lower Left
3	270 degrees	Lower Left
4	No rotation	Centered
5	90 degrees	Centered
6	180 degrees	Centered
7	270 degrees	Centered

p_4 = Font selection

Where:
    0 = 100 points Normal
    1 = 100 points Bold

p_5 = Horizontal (X-axis) Width (before rotation) of Text (data string) Graphic in dots. If the value is zero the text maintains normal font proportions and scales according to the value of the Y-axis (p_6) value.

p_6 = Vertical (Y-axis) Height (before rotation) of Text (data string) Graphic in dots as measured from top of ascender to bottom of decender

Examples:
For 28-point normal, $p_6 = 104$
For 28-point bold, $p_6 = 140$

NOTE: With p_5 a "0," fonts maintain normal proportions, and just p_6 determines font size.

p_7 = Graphic Mode:

Where:
0 = Clear Print Area and load Reverse Bit Map Image

1 = Clear Print Area and load Standard Bit Map Image

2 = Overwrite Background Bit Map Image in Printable Dot Locations, leaving Non-Printing Dot Locations alone

data =
A single line of Modified ANSI Text Data. See Appendix A for the font characters supported.

The printer interprets the <Space> Character as a Command Field Delimiter and the <Enter> character as a Command Terminator. However, except as the first character, the <Space> character may be used within a Text Data String without invoking its Delimiter Function.

To use the <Space> character at the beginning of a Text Data Field, the Leading Bracket character ("[" Dec. 91 or 5B Hex.) must be added as the first character of the Text String. Also, to print a Leading Bracket Character two Leading Bracket Characters must be entered.

V - Check Printer Type/Version

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   This command serves to check the model (and options) of a printer. Serial Port connected printers respond with a Model Number (all designators included) and Firmware Version.

Parallel Port Connected printers respond via the PAPER ERROR and ERROR/ lines of the Centronics Port.

Syntax   `<Esc>V{ p`$_1$`}`

Parameters p_1 = Optional Configuration Parameter (for Parallel I/O) P310/P320, P420, P520, and P720 Printers)

Where:
- None = Returns Printer Type and Firmware Version.
- 10 = No error if P310/P320
- 12 = No error if Magnetic Encoder
- 13 = No error if Smart Card Docking
- 14 = No error if Card Flip
- 20 = No error if Edge-to-Edge Printing
- 50 = No error if Monochrome Printer
- 70 = No error if P520
- 81 = No error if P720
- 90 = No error if printer also has USB Interface

!V - Return Operational Parameter

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Returns value for a selected parameter

Syntax `<Esc>!V{ p`$_1$`}`

Parameters p_1 = Requested parameter

Where for printer module:
- None =
  - Black Printing Parameters
- 0 = Black Printing Parameters
- 1 = X Offset
- 2 = Y Offset
- 3 = Black Contrast
- 4 = Varnish Contrast
- 5 = Hologram Contrast
- 6 = Yellow Contrast
- 7 = Magenta Contrast
- 8 = Cyan Contrast
- 9 = K_{dye} Intensity
- 10 = Yellow Intensity
- 11 = Magenta Intensity
- 12 = Cyan Intensity
- 13 = K_{dye} Intensity
- 14 = p_1 setting for SXY Command
  - 0 = Origin Offset
  - 1 = No Origin Offset
- 15 = Print Head Resistance
- 16 = Black Speed
- 17 = Varnish Speed
- 18 = p_1 setting for +EC Command
- 19 = Smart Card Offset
- 20 = Magnetic Encoder:
  - 0 = Not Connected
  - 1 = Connected
- 21 = Coercivity Setting:
  - 0 = LOCO
  - 1 = HICO
- 22 = Magnetic Encoding Format:
  - 0 = JIS2
  - 1 = ISO
- 23 = Encoder Head Placement:
  - 0 = Below Card Path
  - 1 = Above Card Path

+V - Black Print Speed

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Allows a reduction in print speed for black printing, which affects print quality and throughput

Syntax   `<Esc>+V `p_1

Parameters p_1 = Speed Value

Where:
$p1 = 1 \sim 25$ (Default = 4)

Note: 1 is fast

9 is slow.

+VL - Set Lamination Speed

Models Supported P520c, P520i, P720cP520c, P520i, P720c

Description This command determines the speed that cards pass through the Lamination Rollers. An attempt to enhance performance by increasing speed here in concert with a higher Lamination Temperature can result in heat-distorted cards. Card distortion can produce errors when reading Encoded Magnetic Stripes.

Syntax `<Esc># 1 +VL` p_1

Parameters p_1 = Speed

Where:
  For 1-mil overlaminate ribbon:
  p_1 = 4500 (default — 4.8mm/s)

  For 0.6-mil overlaminate ribbon:
  p_1 = 2000 (11mm/s)

!W - Move Card Backward 8 cm

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	If a card is present in the printer mechanism, it is moved backward 8 cm. The card transport motor is activated even if a card is not present within the mechanism. This command is typically used to test the operation of the card transport mechanism..
Syntax	`<Esc>!W`
Parameters	None

&W - Change Encoding Direction

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Change the direction that the Encoder starts writing and reading operations.
Syntax	`<Esc>&W` p_1
Parameters	p_1 = Direction Select:

Where:
    0 = Forward
    1 = Reverse

>W - Write Data To Smart Card Serial Port

Models Supported	P330i, P430i
Description	This command is used to send data to the smart card serial port. Up to 1024 bytes of data may be sent with a single invocation of the command.
Syntax	`<Esc>>W p`$_1$` data`
Parameters	p1 - Communication mode:
	0 = Contact-type smart card
	1 = Contactless smart card
	Data - Data to send to the smart card serial port. Up to 1024 bytes of data may be sent. See note below for important considerations on how the data field should be constructed.

Some of the rules that apply to uploading image bitmaps also apply to the data field for this command. Any data byte that matches the command lead-in character (ESC, 0x1B) or the end-of-command character (CR, 0x0D) or the control escape character('[', 0x5Bh) must be prefixed with the '[' control escape character. A data pair consisting of a '[' character followed by another character will only count as 1 character for purposes of determining when the 1024-character data limit is reached. The '[' prefix characters (if used/needed) will be stripped out of the data stream sent to the smart card serial port.

>WB - Write Data Formatted in ASCII HEX To Smart Card Serial Port

Models Supported P330i, P430i

Description This command, like the >W command, is used to send data to the smart card serial port. Unlike the >W command, the data field for this command is assumed to be a series of 1 or 2 digit ASCII hexadecimal numbers separate by spaces. Each 1 or 2 digit ASCII hex value is converted to a 8-bit value and sent to the serial port..

Valid ASCII hexadecimal values consist of 1 or 2 digits consisting of the characters 0 through 9 and 'a' through 'f'. Uppercase 'A' through 'F' digits are also allowed. Each value must be prefixed by one and only one space. The examples below illustrate both valid and invalid data streams:

Valid:

05 3a F7 b5 a 94 C 0D AA cd

Invalid:

053a 67   (more than 2 digits w/o intervening space)

05 2g 24   (invalid digit 'g')

27 d4 51   (more than 1 space between values)

Syntax `<Esc>>WB p₁ data`

Parameters p_1 - Communication mode:

　　　　0 = Contact-type smart card

　　　　1 = Contactless smart card

Data - ASCII hexadecimal data stream, as described above.

The command input buffer for the printer is limited to 1024 bytes. A typical ASCII hexadecimal value will consume either 2 or 3 bytes of buffer space per value, thus the number of bytes that can be sent to the smart card interface with a single command is limited to no less than 340 and no more than 512 bytes.

>WG - Contact Internal Gemplus Smart Card Write Command

Models Supported   P330i, P430i

Description   Write data into the Gemplus internal smart card. The data field for this command is assumed to be a series of 1 or 2 digit ASCII hexadecimal values separated by a space. Each 1 or 2 digit ASCII hex value is converted to an 8-bit value and sent to the smart card reader.

Syntax   <Esc>>WG p1 p2 data

Parameters   p1:

   0 = Contact smart card.

p2:

   0 = Connect serial communication port to contact smart card reader.

!X - Check Command Initiator

Models Supported	P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. Printers with parallel interfaces cannot respond to this command, (other than flagging an error). In a test environment, card printers can operate with both interfaces attached and communicating with the printer. The printer CPU board has associated connectors.

Description This command checks for an alternate command initiator. The printer either reports the alternate command initiation character or nothing.

Syntax <Esc>!X

Parameters None

+X - Change Command Initiation Character

Models Supported   P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i

The card printer responds to commands (with data or error codes) via the bi-directional serial interface only. Printers with parallel interfaces cannot respond to this command, (other than flagging an error). In a test environment, card printers can operate with both interfaces attached and communicating with the printer. The printer CPU board has associated connectors.

Description   This command adds an alternate command initiation character. Some host systems cannot transmit an escape command character. The printer responds to both the escape character and the added command initiation character.

NOTE: Never use X as a Command Initiator.

Syntax   `<Esc>+X  p`$_1$

Parameters p_1 = A single ASCII character

NOTE: The single character specified for p_1 must fall within the ASCII code range 33 - 255 (decimal) or 21 - FF (hexadecimal).

Where:
p_1 = 33~255 Decimal
p_1 = 21~FF Hexadecimal

NOTE: To remove an alternate command initiation character, send +X with p_1 < 20Hex (except for 0DHex). A NACK response results, with error code 10 (Syntax Error). The command initiator character will revert to <Esc> (0x1B).

!Z - Re-Synchronize Card

Models Supported   P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description   Prior to printing a card, it must be carefully positioned relative to the print head to ensure that the printed image is properly aligned on the card. This process is typically done automatically when a card is fed in (such as when the MI command is used). This command can be used if needed to ensure that a previously fed-in card is properly positioned under the print head prior to printing.

Syntax   `<Esc>!Z`

Parameters   None

Z/vZ - Load Bit-map (Monochrome)

Models Supported P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c

Description Downloads a Monochrome Bit Map into a Monochrome Image Buffer. The printer uses a preceding "G" Command to specify and control bit-map placement.

The Z command places the bit-map in a buffer used for Resin Printing, and the vZ command places the bit-map in a buffer used for Varnish Printing.

Syntax `<Esc>Zdata{ CHECKSUM}`
`<Esc>vZdata{ CHECKSUM}`

NOTE: No space (20 Hex.) exists between the "Z/vZ" and the "data."

Parameters data =
Uncompressed or Compressed Monochrome Bit-Map data. The Bit-Map data must match the size and dimensions specified in the proceeding "G" command.

See Section 1 for the relationship on how Monochrome Bit-Maps relate to data.

CHECKSUM =
Single byte of XOR data generated from the Image Data. If CHECKSUM is specified by the related G/vG Command, a Checksum must be included here.

Remember, any chance Control Characters that appear among the data require a preceding Open Bracket ([) Character. Control characters include Escape (1B hex), Return (OD hex), and the Open Bracket (5B hex).

Example   The following commands and figure shows a "G"
Command followed by an associated "Z" Command
containing data for the Image Buffer.

```
<Esc>G 200 200 0 2 15 1
<Esc>Z data
```

Figure 2-8
Image Object &
Hexadecimal Code

1 Byte

1B 5A	} EscZ
00 00	
00 00	
00 00	
00 00	
03 F0	
0F FC	
1F FE	
3F FF	} Data
3F FF	
7F FF	
7F FF	
7F FF	
FC 0F	
F0 03	
E0 01	
0D	} CR
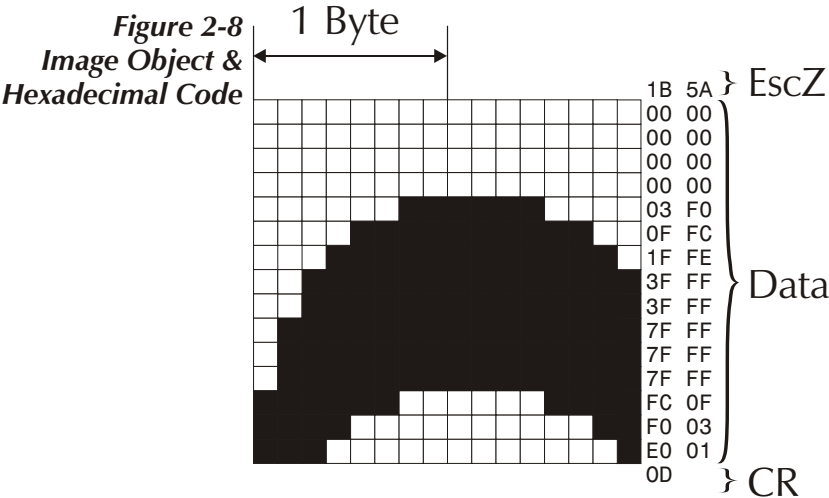
. - Clear Error Status Lines

Models Supported	P110i, P120i, P205, P210i, P310c, P310f, P310i, P320i, P330i, P420c, P420i, P430i, P520c, P520i, P720c
Description	Clears the paper error (paper fault) and error (fault) printer return signal status lines. Note that this command does not execute when sent via the driver. Send the command directly to the parallel port.
Syntax	<Esc>. (period character)
Parameters	None

Executing the <Esc> . command will not clear any displayed error message from LCD or LED displays.

Appendix A

This section contains a listing of all fonts, bar codes, and their respective character sets supported by the EPCL Card Printer Programming Language.

Resident Fonts

The Programming Language supports 2 different fonts; Arial Normal and Arial Bold. The Fonts are proportionally generated by the printer from 100 Point Normal and 100 Point Bold font descriptions.

	Hexadecimal - Most Significant Digit															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**
0	0	16	32	0 48	@ 64	P 80	` 96	p 112	€ 128	144	160	176	À 192	Ð 208	à 224	ð 240
1	1	17	! 33	1 49	A 65	Q 81	a 97	q 113	129	145	161	177	Á 193	Ñ 209	á 225	ñ 241
2	2	18	" 34	2 50	B 62	R 82	b 98	r 114	130	146	162	178	Â 194	Ò 210	â 226	ò 242
3	3	19	# 35	3 51	C 63	S 83	c 99	s 115	131	147	£ 163	179	Ã 195	Ó 211	ã 227	ó 243
4	4	20	$ 36	4 52	D 64	T 84	d 100	t 116	132	148	164	180	Ä 196	Ô 212	ä 228	ô 244
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	165	181	Å 197	Õ 213	å 229	õ 245
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	166	182	Æ 198	Ö 214	æ 230	ö 246
7	7	23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	167	183	Ç 199	× 215	ç 231	÷ 247
8	8	24	(40	8 56	H 72	X 88	h 104	x 120	136	152	168	184	È 200	Ø 216	è 232	ø 248
9	9	25	) 41	9 57	I 73	Y 89	i 106	y 121	137	153	169	185	É 201	Ù 217	é 233	ù 349
A	10	26	* 42	: 58	J 74	Z 90	j 107	z 122	Š 138	š 154	170	° 186	Ê 202	Ú 218	ê 234	ú 250
B	11	27	+ 43	; 59	K 75	[91	k 108	123	139	155	171	187	Ë 203	Û 219	ë 235	û 251
C	12	28	, 44	< 60	L 76	\ 92	l 109	124	Œ 140	œ 156	172	188	Ì 204	Ü 220	ì 236	ü 252
D	13	29	- 45	= 61	M 77	] 93	m 110	125	141	157	173	189	Í 205	Ý 221	í 237	ý 253
E	14	30	. 46	> 62	N 78	^ 94	n 111	126	142	158	174	190	Î 206	Þ 222	î 238	þ 254
F	15	31	/ 47	? 63	O 79	_ 95	o 112	127	143	Ÿ 159	175	¿ 191	Ï 207	ß 223	ï 239	ÿ 255

(Row label: Hexadecimal - Least Significant Digit)

Code 39 (Code 3 of 9)

Code 39 encodes Alphanumeric Characters using five bars and four spaces. Of the nine, three are wide. The Ratio ®) determines wide-to-narrow bar and space widths. The minimum for a Narrow Bar or Space is three dots or 0.010 inch (0.254 mm).

Supported Ratios of narrow bar to wide bar widths are: 2:1, 5:2 (2.5:1), and 3:1.

To calculate the full length of a Code 39 Bar Code:
$$L = [©+2) (3R + 7) - 1] X$$

Where:
L = Length of Bar Code
C = Number of Characters
R = Ratio of wide to narrow bars
X = Number of Dots times 0.0033 inches per dot
(0.0847 mm per dot)
For the 5:2 ratio, the X = Dots times 2

The specified minimum recommended height is 0.25 inches (6.35 mm) or 75 dots. The recommend Quiet Zone is 0.25 inches (6.35mm or 75 dots) or, when larger, 10 times X.

The set of Characters (49) for Code 39 are as follows:

		Hexadecimal - Most Significant Digit							
		0	1	2	3	4	5	6	7
Hexadecimal - Least Significant Digit	0	0	16	32	0 48	64	P 80	96	112
	1	1	17	33	1 49	A 65	Q 81	97	113
	2	2	18	34	2 50	B 62	R 82	98	114
	3	3	9	35	3 51	C 63	S 83	99	115
	4	4	20	36	4 52	D 64	T 84	100	116
	5	5	21	% 37	5 53	E 69	U 85	101	117
	6	6	22	38	6 54	F 70	V 86	102	118
	7	7	23	39	7 55	G 71	W 87	103	119
	8	8	24	40	8 56	H 72	X 88	104	120
	9	9	25	41	9 57	I 73	Y 89	106	121
	A	10	26	* 42	58	J 74	Z 90	107	122
	B	11	27	+ 43	59	K 75	91	108	123
	C	12	28	44	60	L 76	92	109	124
	D	13	29	- 45	61	M 77	93	110	125
	E	14	30	. 46	62	N 78	94	111	126
	F	15	31	/ 47	63	O 79	95	112	127

Standard 2 of 5
(Code 2/5) The 2 of 5 Code Symbology encodes all information in the width of the bars. Spaces carry no information . Bars are wide or narrow and the Wide Bars are set by the Ratio ®). Spaces are the same width as the narrow bars.

2 of 5 Code supports the numeric characters:

0 through 9

The supported ratio of narrow bar to wide bar widths are: 2:1, 5:2 (2.5:1), and 3:1.

To calculate the full length of a 2 of 5 Bar Code:

$$L = [\, C\,(2R + 8) + 14]\, X$$

Where:
L = Length of bar code
C = Number of characters
R = Ratio of wide to narrow bars
                    (For 5:2, $R = 2.5$)
X = Number of Dots times 0.0033 inches per dot
                    (0.08847 mm per dot)
For 5:2 ratio, the X = Dots times 2

The specified minimum recommended height of a Code 2/5 Bar Code is 0.25 inches (6.35 mm) or 75 dots. The recommend "Quiet Zone" is 0.25" (6.35mm or 75 dots) or, when larger, 10 times X.

Interleaved 2 of 5 (Code I 2/5)

The name Interleaved 2 of 5 derives from the method used to encode two characters. The Bar Code Symbol pairs two characters, using bars to represent the first character and the interleaved spaces to represent the second character. Therefore, each character has two definitions, one for bars and the other for spaces. Each consists of two wide elements and three narrow elements. Bars and spaces are wide or narrow and the wide bars are set by the Ratio ®).

Interleaved Two of Five Code supports the numeric characters:

0 through 9

The printer automatically adds a leading Zero (0) Character) to Code I 2/5 Bar Codes with an odd number of Bar Code Data Characters.

The supported ratio of narrow bar to wide bar widths are: 2:1, 2:5 (2.5:1), and 3:1.

To calculate the full length of an I 2/5 Bar Code:

$$L = [C (2R + 3) + 6 + R] X$$

Where:
L = Length of bar code
C = Number of characters
R = Ratio of wide to narrow bars (5:2=2.5)
X = Number of Dots times 0.0033 inches per
dot (0.08847 mm per dot)

Where:

The minimum recommended height of a Code I 2/5 Bar Code is 0.25 inches (6.35 mm) or 75 dots. Ideally the Bar Code Height should be 15% of the Bar Code Length. The recommend "Quiet Zone" is 0.25" (6.35mm or 75 dots) or, when larger, 10 times X.

UPC-A UPC (Universal Product Code version A) is the basic version of UPC and is usually the version seen on grocery store items in the United States. The symbology encodes 10-digit Universal Product Code numbers. An eleventh digit, at the beginning, indicates the Type of Product, and a twelfth digit is a Module Check Digit.

The UPC Code Number and check digit are assigned by:

Uniform Code Council (UCC)
8163 Old Yankee Rd., Ste. J, Dayton, OH 45458 Phone (513) 435-3870; Fax: (513) 435-4749

UPC-A code supports the numeric characters:

0 through 9

The printer ignores the Ratio Command Parameter (narrow bar to wide bar width).

The equation to calculate the UPC-A Bar Code length is:

$$L = (91) X$$

Where:
L = Length of bar code
X = Number of Dots times 0.0033 inches per dot
(0.08847 mm per dot)

UPC-A Bar Code Height, by specification, is six individual UPC-A bar code characters high. The following equation can be used to calculate the Industry Specified Height in dots.

$$H = (42) X$$

Where:
H = Height of Bar Code in dots
X = Bar Code Multiplier

Multiply the height of the bar code in dots by 0.0033 inches per dot (0.08847 mm per dot) to get the actual height of the Bar Code .

EAN-8   European Article Numbering, now also called IAN
(International Article Numbering), is the International
Standard Bar Code for retail food packages,
corresponding to the Universal Product Code (UPC) in
the United States. The symbology encodes a seven-digit
EAN-8 number. The printer automatically generates an
eighth Check Digit.

Numerous international agencies assign EAN Code
Numbers and Check Digits. See the list at the end of this
appendix.

EAN-8 Code supports the numeric characters:

0 through 9

The printer ignores the Ratio Command Parameter
(narrow bar to wide bar width).

The equation to calculate the EAN-8 Bar Code Length
is:

$L = (67) X$

Where:
L = Length of bar code
X = Number of Dots times 0.0033 inches per dot
(0.08847 mm per dot)

EAN-8 Bar Code Height, by specification, is six (6)
individual EAN-8 bar code characters high. The
following equation can be used to calculate the Industry
Specified Height in dots.

$H = (42) X$

Where:
H = Height of Bar Code in Dots
X = Bar Code Multiplier

Multiply the height of the Bar Code in dots by 0.0033
inches per dot (0.08847 mm per dot) to get the actual
Bar Code Height.

EAN-13 EAN-13 is one of two versions of the European Article Numbering system (EAN) and is a super set of UPC. EAN-13 has the same number of bars as UPC Version A, but encodes a 13th digit. The 12th and 13th digits define the Country Code. The codes 00-04 and 06-09 are assigned to the United States.

Numerous international agencies assign the EAN-13 Code Numbers. See the list at the end of this appendix.

EAN-13 Code supports the numeric characters:

0 through 9

The printer ignores the Ratio Command Parameter (narrow bar to wide bar width).

The equation to calculate the EAN-13 bar code length is:

$$L = (98) X$$

Where:
L = Length of Bar Code
X = Number of dots times 0.0033 inches per dot
                    (0.08847 mm per dot)

EAN-13 Bar Code Height, by specification, equals six individual EAN-13 Bar Code Characters. The following equation can be used to calculate the Industry Specified Height in dots.

$$H = (42) X$$

Where:
H = Height of Bar Code in dots
X = Bar Code Multiplier

Multiply the height of the Bar Code in dots by 0.0033 inches per dot (0.08847 mm per dot) to get the actual Bar Code Height.

Code 128 Subsets B & C

Code 128 is a high density Alphanumeric Bar Code. Zebra printers in Code 128 B Mode encode single digit alphanumerics as single Bar Code Characters. The printer in Code 128 C Mode encodes two numeric digits as a Single Bar Code Character.

The printer accepts ASCII input data and encodes with a Code 128 Bar Code Value (or digit). The following table shows the Code 128 B Encoded Value and corresponding ASCII Characters supported by the printers. Code 128 C encodes numeric ASCII pairs (i.e., 0 & 5 would encode to the single Code 128 C digit 05. The printers automatically add a leading zero character to data specifying an odd number of Code 128 C Bar Code Characters.

The percentile (%) character must precede another percentile character to encode.
Example: %% = %

Encoded Value	Code A	Code B	Code C	Encoded Value	Code A	Code B	Code C	Encoded Value	Code A	Code B	Code C
0	SP	SP	00	37	E	E	37	74	LF	j	74
1	!	!	01	38	F	F	38	75	VT	k	75
2	"	"	02	39	G	G	39	76	FF	l	76
3	#	#	03	40	H	H	40	77	CR	m	77
4	$	$	04	41	I	I	41	78	SO	n	78
5	%	%	05	42	J	J	42	79	SI	o	79
6	&	&	06	43	K	K	43	80	DLE	p	80
7	'	'	07	44	L	L	44	81	DC1	q	81
8	(	(	08	45	M	M	45	82	DC2	r	82
9	)	)	09	46	N	N	46	83	DC3	s	83
10	*	*	10	47	O	O	47	84	DC4	t	84
11	+	+	11	48	P	P	48	85	NAK	u	85
12	,	,	12	49	Q	Q	49	86	SYN	v	86
13	-	-	13	50	R	R	50	87	ETB	w	87
14	.	.	14	51	S	S	51	88	CAN	x	88
15	/	/	15	52	T	T	52	89	EM	y	89
16	0	0	16	53	U	U	53	90	SUB	z	90
17	1	1	17	54	V	V	54	91	ESC	{	91
18	2	2	18	55	W	W	55	92	FS	|	92
19	3	3	19	56	X	X	56	93	GS	}	93
20	4	4	20	57	Y	Y	57	94	RS	~	94
21	5	5	21	58	Z	Z	58	95	US	DEL	95
22	6	6	22	59	[	[	59	96	FNC3	FNC3	96
23	7	7	23	60	\	\	60	97	FNC2	FNC2	97
24	8	8	24	61	]	]	61	98	SHIFT	SHIFT	98
25	9	9	25	62	^	^	62	99	CodeC	CodeC	99
26	:	:	26	63	_	_	63	100	CodeB	FNC4	CodeB
27	;	;	27	64	NUL	.	64	101	FNC4	CodeA	CodeA
28	<	<	28	65	SOH	a	65	102	FNC1	FNC1	FNC1
29	=	=	29	66	STX	b	66	103	Start A	Start A	Start A
30	>	>	30	67	ETX	c	67	104	Start B	Start B	Start B
31	?	?	31	68	EOT	d	68	105	Start C	Start C	Start C
32	@	@	32	69	ENQ	e	69				
33	A	A	33	70	ACK	f	70				
34	B	B	34	71	BEL	g	71				
35	C	C	35	72	BS	h	72				
36	D	D	36	73	HT	i	73				

The printer ignores the Ratio Command Parameter (narrow bar to wide bar width).

The equation to calculate the Code 128 B Bar Code length is:

$$L = [C (11) + 24] X$$

Where:
L = Length of bar code
C = Number of characters & checksum character
X = Number of Dots times 0.0033 inches per dot
(0.08847 mm per dot)

The equation to calculate the Code 128 C Bar Code Length is:

$$L = [(11 C) / 2) + 24] X$$

Where:
L = Length of Bar Code
C = Number of characters (rounded up to the
next even digit) & checksum character
X = Number of dots times 0.0033 inches per dot
(0.08847 mm per dot)

The minimum recommended height of a Code 128 bar code is 0.25 inches (6.35 mm) or 75 dots. Ideally the Bar Code Height should be 15% of the Bar Code Length. The recommend "Quiet Zone" is 0.25 inches (6.35mm or 75 dots) or, when larger, 10 times X.

General Specifications for the Article Symbol Marking (1987), EAN Prefix List
EAN International (EAN)
Rue Royale 29, B-1000 Bruxelles (Belgium)

Reinhold Van Lennep, Secretary General

prEN 797 Bar coding - Symbology specifications - EAN/UPC
NNI
P.O. Box 5059, NL-2600 GB DELFT
THE NETHERLANDS

ANSI
11 West 42nd Street, 13th floor
New York, N.Y. 10036, USA

Australian EAN Coding Authority
Australian Product Numbering Association, Ltd. (APNA),
Unit 8, 417 Femtree Gully Rd.
Mount Waverlet, Vidoria 3149, Australia

England EAN Coding Authority
Article Numbering Assoc. (UK) Ltd. (ANA)
11 Kingsway
London WC2B 6AR, England

Japan EAN Coding Authority
Distribution Code Center (DCC)
No. 3 TOC-Bldg.7-23-1
Nishigotanda, Shinagawaku, Tokyo 141, Japan

Mexico EAN Coding Authority
Asociacion Mexicana del Codigo de Producto (AMECOP)
Horatio,1855-6O, Col. Polanco, DFCP 11570, Mexico

New Zealand EAN Coding Authority
New Zealand Product Number Association, Ltd.
PO Box 11-110, Wellington, New Zealand

South Africa EAN Coding Authority
South Africa Numbering Association
PO Box 41417, Craighall, 2024, Johannesburg, South Africa

Appendix B

This section contains Status and Error Reporting information for Color and Monochrome Card Printers.

Parallel Port Printer Data Handshake Signal Lines

The Busy and Acknowledge signal lines transfer data to the printer only.

Parallel Port Printer Error Response

The Color Card Printers respond to Error Conditions with combinations of the Error and Paper Error signals at the Parallel Interface. Detailed Error Responses are sent via the Serial Port only.

Paper Error	Error	Description
0	1	No Error
0	0	Syntax Error
1	1	Ribbon End or Empty Feeder
1	0	Mechanical Error
NOTE: To clear an Error, Send: <Esc>.<Enter> (1B 2E 0D Hex)		

Serial Port Printer Data Handshake

Some programs use Acknowledge (ACK) and Not Acknowledge (NACK) to display these communication protocol responses. The ACK response signals Command Accepted, Waiting for Command. The NACK response signals an Error or Check Status condition

exists and typically includes a corresponding error or status code. The NACK can also signify an Input Buffer Full condition.

Serial Port Printer Error Response

The printers respond, via the Serial Port, to various conditions with Status and Error Codes.

Status and Error Responses have the following format:

(NACK)05(EOT) - Card in Magnetic Encoder.

Code	Error	Status	Condition
-1	•		Mechanical Error - Printer
01	•		Ribbon Broken/Missing
02	•		Temperature
03	•		Mechanical
04	•		Feeder Empty
05		•	Card In Encoder
06		•	Card Not In Encoder
07	•		Cover or head latch open, or cleaning in progress
08	•		Printer busy
09		•	Remove ribbon (req during cleaning)
10	•		Invalid Command or Parameter
11	•		Invalid Coordinates (Image placement)
12	•		Unknown Bar Code Reference
13	•		Unknown Text/Font Reference
14	•		Unknown Command
15	•		Invalid bar code size
20	•		Bar Code Data Syntax
21	•		Text Data Syntax
22	•		Graphic Data Syntax
30	•		Graphic Image Initialization - Failed
31	•		Graphic Image Maximum Width Exceeded
32	•		Graphic Image Maximum Height Exceeded
33	•		Graphic Image Data Checksum Error
34		•	Data Transfer Time-out
35	•		Check ribbon
40	•		Parameter/Syntax
41	•		Mag. Encoder Write
42	•		Mag. Encoder Read/Verify
43	•		Mag. Encoder Mechanical
44	•		Mag. Encoder Not Responding
45	•		1) Magnetic Stripe Missing 2) Card Jam
50	•		Card flipper jam
60	•		FLASH write error
61	•		End of ribbon

Appendix C

This section contains information for operation and formatting for the magnetic stripe encoder.

Magnetic Encoders

All printers with encoders write and read ANSI 4.16 and ISO 7811/2/3. Encoder track positions are fixed and cannot be modified.

Two encoder read write head mounting options exist:

Below the Card Path—The standard mounting that supports down-facing magnetic stripes when loading cards

Above the Card Path—An optional mounting that supports up-facing magnetic stripes when loading cards.

The read-write heads are positioned just beyond the print head for both options

Forward Recording Direction

Recording Area
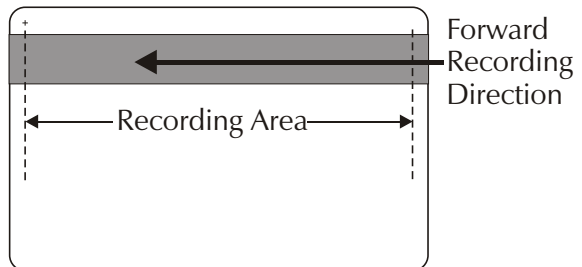
Encoder Operation

The encoder executes commands received one at a time. When the encoder receives a command, it performs the requested action and reports the result. The printer cannot execute a new encoder command prior to completion of the previous encoder command. Detailed encoder (and general printer) status Information is reported to the host via an optional serial interface port only. See Appendix B for a detailed listing of printer and encoder responses.

Write   The encoder, in default configuration, can write in the forward or reverse directions and then automatically perform a write-verifying data read. The printer then repositions the card to the print-ready position. Note that for ISO encoding, the encoder attaches the start, stop, and LRC characters, which should not be included in data downloads.

Read   The encoder can only read (back to the host) a single track of data at a time. The &L command performs read-only operations, see command reference, page 2-73.

However, the "M or m" commands can serve as linking operators for several read commands. The encoder performs each command in the string until completion of the command string. An error terminates an "M" Command string, while command execution resumes with error correction for an "m" Command string. The "M" command concatenates the read data into a single response to the host.

Example of Multiple Read Command String
(Escape and carriage returns not shown)

Track 1 *data* = 1111
Track 2 *data* = 2222
Track 3 *data* = 3333

Multiple read command string is:

`<Esc>M 1 &L1[&L2[&L3`

Data sent to the host, in a single response:

111122223333

Data Errors	The encoder retries, up to six times, any read or write (write-verify read) operation, before reporting an error.	

Encoder Default Configuration	The encoder reads and writes standard ANSI/ISO track data formats in the standard ANSI/ISO track locations. The following shows the three standard ANSI/ISO tracks.	

Track 1 - 210 bpi
Track 2 - 75 bpi
Track 3 - 210 bpi
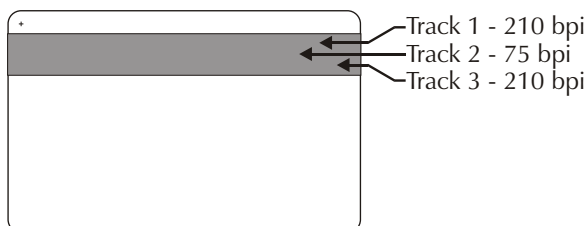
Each track can be encoded and decoded with ASCII characters in the standard default ANSI/ISO data formats.

Track	Density	Data Format	Data Characters	Data Separator
1	210 BPI	7 Bit (6 data, 1 parity)	Space $ ( ) - / Enter 0 through 9 A through Z (All Caps)	^
2	75 BPI	5 Bit (4 data, 1 parity)	0 through 9	=
3	210 BPI	5 Bit (4 data, 1 parity)	0 through 9	=

The ANSI/ISO data formats include a preamble (all zeros), a start character, data (7-bit or 5-bit as specified by ANSI/ISO), a stop character, and a longitudinal redundancy check character. The 7-bit data format has 6 bits of encoded data and a parity bit. The 5-bit data format has 4 bits of encoded data and a parity bit.

The ANSI/ISO data formats include a data field separator (or delimiter) that allows parsing of the encoded track data. An example of separate data fields would be the American Bankers Association (ABA) data format (normally located on track 2) that includes a primary account number (PAN) field and an account information field (for expiration date, country code, etc.).

The encoder reports a data error when the total number of data characters exceeds the maximum allowed by physical encoding (bit density) and the data format in any read or write data function.

Basic Commands   All card printers with encoders, perform the basic
functions of reading and writing to ANSI/ISO tack and
data formats. The commands for these basic encoder
functions are as follows:

Basic Encoder Commands		Page
&E	Encode Single Data Track	2-47
&B	Buffer Single Track Data	2-5
&E*	Encode All Data Tracks	2-48
&L	Read Single Track Data	2-73

Advanced Encoder   Printers with magnetic stripe encoders have an expanded
    Commands   encoder command set. These commands allow
programmers to create custom data and track formats.

The encoder can be programmed to read and write
custom data and formats. The encoder can be
programmed to use standard ANSI/ISO data formats on
one or other ANSI/ISO track locations. For example, the
encoder can be programmed to read and write ANSI/ISO
track 3 data format on track 1. When in this mode, the
advanced encoder commands support encoding of and
decoding to host with ASCII character data. The encode
automatically adds the selected ANSI/ISO data
formatting. The encoder reports errors when reading and
writing in this mode.

The encoder does not accept ASCII characters that are not
part of the selected ANSI/ISO data character set. See Page
C-3 for a table containing the character sets.

The following lists the advanced encoder commands:

Advanced Encoder Commands		
&R	Reset encoder	2-118
&B	Buffer track data	2-5
&L	Read single track data	2-73
&W	Change encoding direction	2-154
&D	Change track density	2-40
&CDEW	Custom write format	2-25
&CDER	Custom read format	2-5

The encoder does not write data unless the read buffer is
programmed to read identical data parameters. Otherwise,
an error occurs.

Resetting The Encoder To ANSI/ISO Track Defaults	To ensure a proper encoder configuration, the programmer should reset the encoder to ANSI/ISO track data, format, density and location.
	Reset the encoder to ANSI/ISO defaults with the following command sequence.
Example:	(escape and carriage returns not shown)
	&R &CDEW 0 0 &CDER 0 0

The encoder stores the track settings in flash memory. If the encoder is powered down, the printer retains the last encoder read, write, and track density settings.

Change Track Density	The &D command allows changes in the density of a track. &D command changes occur to a given track density without changing the related data format or character set. See command reference &D, page 2-40, for command details.

Changing Read Configuration	The &CDER command serves to change the read data format configuration. This command can configure a given track to: • Its ANSI/ISO data format.
	• Change it to another ANSI/ISO track format.
	• Allow forward or reverse data reads.
	• Change to raw data format, which has custom track data formatting and data block encoding.

The &L read command needs to be configured to read raw (or hexadecimal) custom data.

Changing Write Configurations	The &CDEW command allows changes to the read data format configuration. This command can configure a given track to: • Its ANSI/ISO data format.
	• Change to another ANSI/ISO track format.

• Change to raw data format having custom track data format and data block encoding.

	The &B read command needs to be configured to store to write raw (or hexadecimal) custom data.

|	
Custom ISO Data	The encoder can be configured to process ISO track data in non-ISO track locations. The printer interprets and processes the ASCII data normally. The custom data control commands are &D (track density), &CDER (read data format) and the &CDEW (write data format).
	The printer automatically read-verifies after a write, so all three commands (&D, &CDER, and &CDEW) must be properly configured to function without reporting a data error.

Unique Custom Data Formats

The encoder is capable of reading and writing non-ANSI/ISO data. The data block and the track data string formatting is "stripped away" and "passed through" the encoder (and printer) without error checking, encoding, or decoding. The host sends and receives raw hexadecimal data strings.

Each hexadecimal block sent to the encoder represents a block of magnetic card encoded data. The encoder stripes the most significant bits of the data blocks off of each hexadecimal block.
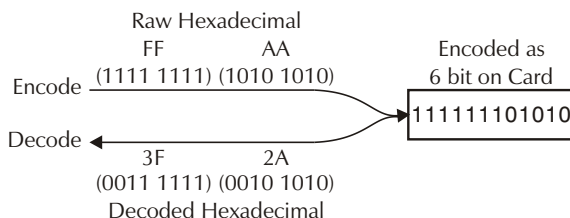
Raw hexadecimal data, when encoded, requires the following elements in the final binary data string:

• **Preamble data**—The minimum number of leading binary "0" bits (i.e., NUL characters). Note: the NUL (00 hexadecimal) is normally sent to the printer with a character like the @ symbol (40 hexadecimal) and is encoded as all zero bits in 6 (or lower) Bit Data Mode.

     75bpi - 20 min., 24 nominal, 1024 max.
     210bpi - 40 min., 68 nominal, 1024 max.

• **Start Bit**—The first binary "1" bit detected starts data block grouping. The LSB (least significant bit) of the first character sited in a data block is the start bit.

• **NUL Data Block**—Without NULs enabled, the encoder terminates the data string or causes the data string to restart with a new start bit, a data block with a "1's" bit.

• **NUL Data Block with NULs enabled**—Allows the inclusion of NUL data character blocks within the data string.

• **Postamble**—binary "0" bits, (i.e., NUL characters) fill remainder of track.

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980471-001